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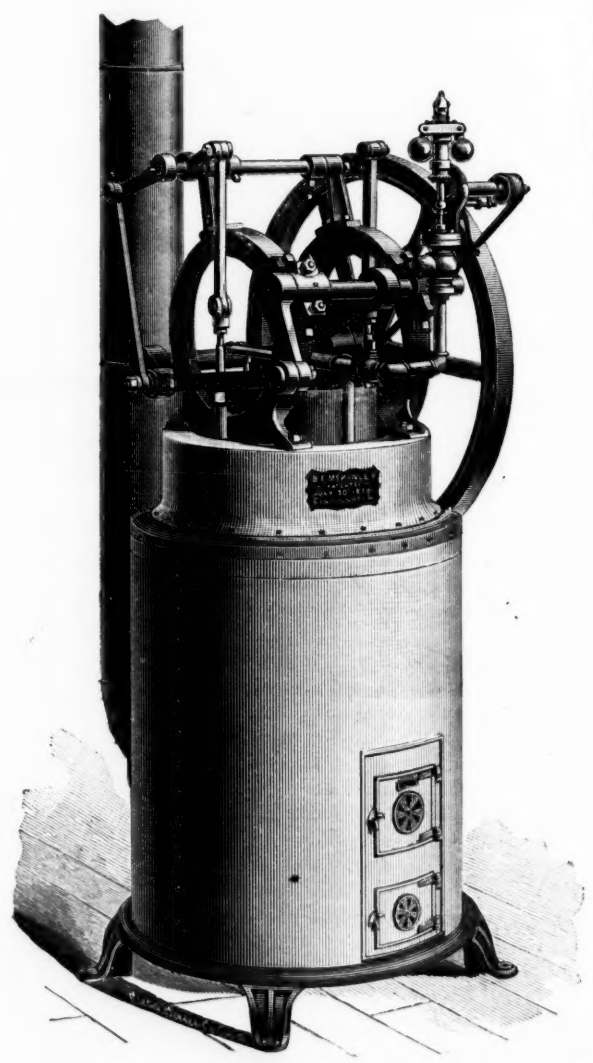
The McKinley Hot-Air Engine.

This engine derives its power from an alternate pressure of air, contained below the working piston for the out stroke, and a partial vacuum for the return stroke.

These different conditions are produced by changing the temperature of the air above and below a certain mean average temperature that at any given time corresponds to the atmospheric pressure. When the temperature rises above this point, it gives a pressure correspondingly above that of the atmosphere, whereby the piston of the engine is forced up; and when the temperature falls below this average point, then the pressure within the engine falls below the atmospheric pressure, and the piston is thereby forced down. The perspective view shows the arrangement of cranks and connections by which the movement of the working piston is carried to the crank shaft, and a proper motion of other parts is effected.



THE McKINLEY HOT AIR ENGINE.

Fig. 2 is a vertical central section. B is the cylinder fitted with the working piston D. In open communication with this cylinder is a chamber, formed by the two concentrically corrugated plates A and A_1 and a ring A_2. Within this chamber is a diaphragm E, made as nearly as possible non-conducting for heat. This diaphragm has attached to it, above and below, concentric flanges, adapted to enter the inside corrugations in plates B and A_1, and receives a reciprocating movement between said plates alternately with the working piston, by means of which movement the air inside is transferred back and forth between the upper and lower parts of the chamber, which is termed the regenerator. Arranged around the periphery of this diaphragm, and between the plates A and A_1 and within the ring A_2, are a great number of finely-divided pieces, through which the air passes in its way back and forth within the chamber.

The lower plate A_1 rests upon the upper edge of the drum G, which in turn rests upon the base plate. Bolts passing through lugs upon the edge of plates A and A_1, and through the base plate, fasten all these parts together. Within this case is arranged a furnace, which is a drum lined with tile or fire-brick. A deflecting plate guides the products of combustion in close contact with plate A_1 into the annular flue S. The lower edge of drum G is perforated with holes d, through which air enters the ash-pan below the grate.

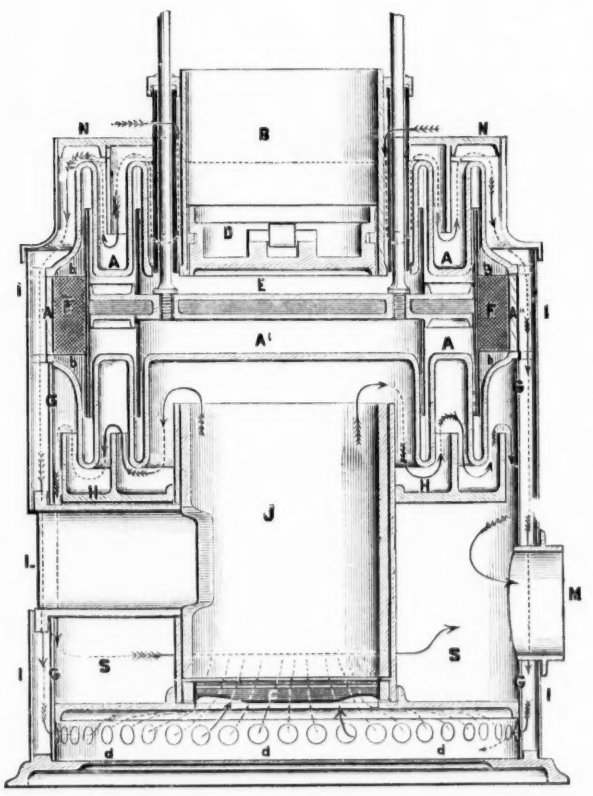
Entirely surrounding the regenerator and case G is another case I, somewhat larger, enclosing an annular space. The upper part of this case I conforms in shape to plate A, and closes up with the outer edge of the base ring N, which carries concentric flanges that descend into the outside corrugations of plate A. By means of these concentric flanges, the ring N and the outside case I, a continuous air-space is formed, by which a current of air, entering near the top of cylinder, is made to flow over the surface of the cylinder, the upper surface of the regenerator, the outside surface of the furnace case G, and enter the ash-pan through holes d, to feed the fire. The first effect of this current of cold air is to come in contact with the cylinder, keeping it cool; from this it passes to the somewhat warmer plate A, keeping its temperature down also. After this it passes over the furnace casing, still warmer from the escaping furnace gases, and keeps its temperature down also, and finally enters the ash pan.

A fire being built within the furnace, the plate A_1 becomes quite hot in the center—the heat being less intense towards its outer edge. The lower part of the diaphragm also becomes heated, as do the lower layers of wire cloth, and the upper layers also to a less extent. If now the diaphragm be caused to move up, the air above it, which is cool, will be made to pass over the inside of the upper plate A, and down through the layers of wire cloth, becoming heated more and more as it passes through layers that are more highly heated; thence over the outer part of the plate A_1, which is still hotter, and over its inside surface, gradually increasing in temperature until the greater part of the air reaches the central part of said plate next the fire. By these means the air is gradually but rapidly heated, causing the pressure to rise and force up piston D, when the stroke of the piston is completed. As the crank turns the center, the diaphragm is made to descend and the heated air is made to pass back again, coming in contact with the surfaces again, and, being hotter, gives off heat to them. As its temperature is reduced, it comes in contact with still cooler surfaces, and is thus gradually but rapidly cooled until the pressure falls below the atmospheric pressure by which the working piston will be driven down again.

These successive movements of working piston and diaphragm are produced by attaching each to a crank movement that is at right angles, or nearly so, with the other, so that while one is passing the center, and moving slowly, the other is moving rapidly and *vice versa*. As these operations are repeated upon the same body of contained air in the engine, and no air is supposed to escape or be introduced, there is no necessity for induction or eduction valves, and the only valve used is a small one operated by the governor that keeps the speed uniform by allowing a small quantity of air to pass, in order to keep the engine down to a given rate of speed.

It will be seen that as the air passes back and forth in the regenerator that it gives up heat to the surface, and in turn receives it back from the surface again.

In so far as this goes, the necessity is obviated of receiving heat from the fire or being cooled by the current of cool air above. The change of the direction of the movement of the diaphragm changes at the same time the functions of the entire engine surface (except a very small portion at the extremes of the hot and cold parts, from heating to cooling, and *vice versa*. That is, when the movement is such as to cause the air to be cooled then almost the entire surface of both plates, diaphragm and all the regenerating surface becomes cooling in its effect; that is, the air brought into contact with any given surface is hotter than the surface it is in contact with and is cooled by the contact, and a reversal of the motion brings about an exactly contrary state; that is, the air in every part of the engine is cooler than the surface in contact, and is consequently heated by the contact.



The engine is entirely self-contained, and needs nothing but a stove-pipe connection to a flue to make it ready for fire and work.

The manufacturers of these engines are the McKinley Engine Company, Cincinnati, Ohio.

A scientific contemporary illustrates and describes a steam-engine in which the crank is dispensed with, and which "obtains a uniform leverage throughout the entire stroke, thereby avoiding loss of power due to the use of the crank." We had supposed that the fallacy that there was loss of power in the crank had been so fully and so frequently exploded that none of the fragments were left. In the case of this engine, two additional cylinders are used, the number of parts acting under friction increased, and a complicated and undesirable construction adopted, all to avoid a loss that exists only in the imagination. The following from a lecture by Coleman Sellers, Jr., before the Franklin Institute might be occasionally quoted to the advantage of others than inventors: "There are many cranks besides the crank that turns the grindstone; but the worst crank is the crank who is going to improve on the crank."

Postal Telegraph Wanted.

The present Congress has an opportunity to confer a lasting benefit upon the country if it will only pass some bill to establish a postal telegraph. Why should not the post-office take the benefit of telegraphs as well as railroads? There are a few Rip Van Winkles who would like to see everything conducted as it was twenty years ago. They rise up to protest against every innovation. But the people at large decidedly want a postal telegraph. It would be but little trouble to start a Government telegraph between the principal cities. Once in operation public sentiment would demand its extension, and in a few years people would wonder how they got along patiently without it.

A Novel Chimney Staging.

BY FREDERICK G. COGGIN.

A PAPER READ BEFORE THE CHICAGO MEETING OF MECHANICAL ENGINEERS.

In the Fall of 1885, the Calumet and Hecla Mining Company completed a new brick boiler house for its stamping and concentrating works at Lake Linden, Mich. It was 206 feet long and 70 feet wide, giving room for fourteen fire-box boilers, whose shells are 90 inches in diameter, with a total length of 34 feet.

The chimney designed for this boiler-house was to be of wrought iron, 13 feet 7 inches in diameter and 165 feet high, above the brick base upon which it stood, and the top of the latter was 20 feet above the ground, making a total height of 185 feet above the surface.

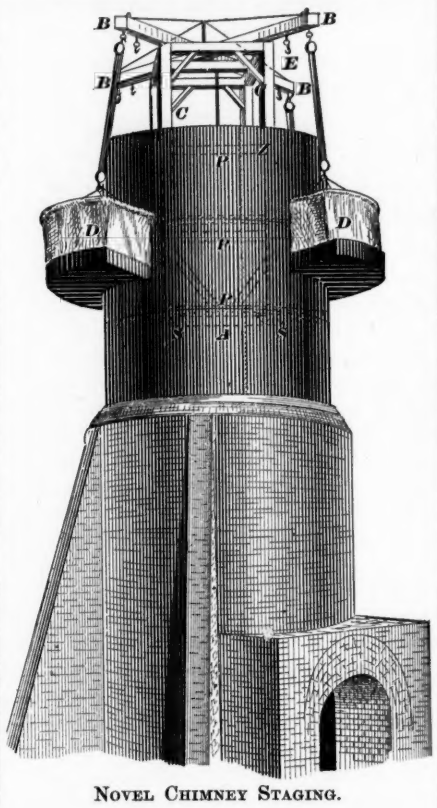
The courses were five feet high with four sheets in each course, the ends and edges butted together, the joints being covered with straps riveted to the sheets on the outside.

The first ten courses were $\frac{3}{8}''$ thick, the second $\frac{5}{16}''$, the third $\frac{1}{4}''$, the top three courses $\frac{3}{16}''$ thick. The late arrival of the material for the chimney, with other circumstances, brought the commencement of its erection rather late in the season, so that it became a serious question as to whether it could be completed in time to allow the brick lining to be put in before the freezing weather set in. In fact, it became evident that with the ordinary method of staging it could not be done. Such a staging would have required ten uprights of 8″x8″ timber, with the bracing necessary to hold them in position, and girting, and provision for a platform every five feet—*i. e.* for every course—sufficiently strong and wide to allow the workmen to stand outside for holding rivets and bolting together, all requiring not less than 26,000 feet of lumber.

Such a staging would have to be put up in sections, during the operations for which the iron work would have to be suspended, and the time put upon the staging and platforms would be nearly as much as that for putting the plates in position and riveting, and the expense full as much. But, regardless of the question of extra cost, the delay which such a staging would occasion made it imperative to devise some more rapid method for raising the chimney, and the result was the plan illustrated.

This consisted of a frame about nine feet square, with four 8″x8″ uprights 16 feet long, suitably braced and bolted together, with a platform at the bottom, one about four feet from the bottom, which carried the workmen while riveting, and one still higher for carrying the forge, etc., the platforms being indicated by the letter *P*.

Upon the top of this frame were four arms *B* jointed at the center, through which it was bolted to a cross girt, but so as to allow it to swing freely. To the ends of these arms were suspended the cages *D* by blocks and falls, as shown. These cages extended a little more than one-quarter round the chimney, and consisted of a segmental platform about three feet wide, with a railing of gas pipe, and covered with canvas, to protect the workmen from the wind, and prevent the possibility of their falling. The whole thing required less than 1,000 feet of lumber. The frame having been bolted together within the chimney base, the process of erection might be begun. The cast-iron ring, upon which the chimney was to rest, having been put in place upon the top of the base, a loose platform was laid over the opening, and the first two courses were raised into place with a "gin-pole" and bolted together. Two snatch blocks were then hooked on to the upper sheet near the two opposite corner posts of the frame, at the bottom end of which were eye-bolts, into which were hooked the hoisting ropes which passed up through the blocks and down to the bottom through another pair of blocks on to the drum of a small steam hoisting machine. The temporary platform was then removed, and the frame was raised high enough so that the two sticks of timber *A* could be placed on top of the base under the uprights. The cross bars *B* were then put in place, and the cages *D* suspended, and the two courses were riveted together. The gin-pole was now laid aside, and the third course was put in place by the method to be used from that point to the top, the ease and facility of which are worth noting. In the arms *B*, just back of the eye-bolts to which the cages were suspended, were other eye-bolts *E*, into which was hung a snatch block, over which was passed a rope leading from the hoisting machine, and hooked into the sheet upon the ground. As the sheet was raised, the cage was swung out to allow it to



NOVEL CHIMNEY STAGING.

pass up behind it, the sheet swinging naturally and easily into place, where it was secured with bolts. When the whole course was thus secured, the snatch blocks were hooked on to the sheet as before, and the frame raised as before, so that the loose cross beams *A* could be laid into the stirrups *S*, which had previously been bolted in place at the horizontal seam, and from this point up the frame—except when it was being raised—was resting upon the two cross beams *A* hanging in the four stirrups, of which there were two sets, so that while the frame was hanging in one the other could be transferred to the seam above. There was, therefore, no delay, for, as each course was riveted up and another bolted in place ready for riveting, but a few moments were required to hook on the snatch blocks, raise the frame, transfer the cross beams *A* to the next set of stirrups, and drop the frame on to them. The sheet being riveted one-quarter round on the opposite sides, the cross bars *B* were swung so that the cages covered the other two quarters and the riveting was completed.

In this way this traveling staging, carrying eleven men, went to the top with no trouble whatever, the operations following each other in rapid succession, and within twenty-seven working days from the driving of the first rivet at the bottom, the last rivet was driven at the top, including the hanging of three sets of guys and painting the chimney inside and out. A cast-iron capping has been put in place, a permanent iron ladder was hung from top to bottom.

The cages were then lowered to the ground and the frame taken apart and dropped, two pieces of timber being laid across the top from an eye-bolt, in which were hung blocks and falls for the purpose of raising a platform, which carried the masons and material for putting in an eight-inch lining, which was done in about twenty days. The blocks were then lowered and the cross timbers dropped, and a completed chimney stood as a testimonial of the quickest time on record for such a job. The total weight of the chimney, including the base, ring and cap, is 100,105 lbs. The cost for the labor, including punching and rolling the sheets and straps, and all labor incidental to the erection, did not exceed $2\frac{1}{10}$ cents per lb.

The Start of an Extensive Business.

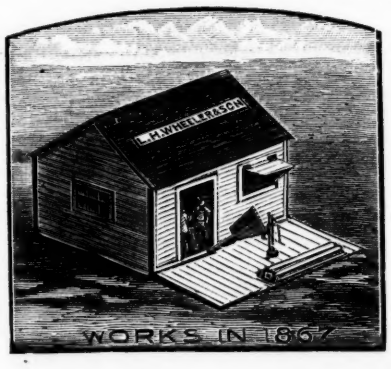
Our correspondent, Robert E. Masters, lately in the employ of the Eclipse Wind Engine Co., sends us the following in regard to the building up of those works:

In the winter of 1865, Mr. L. H. Wheeler, Sr., a missionary among the Chippewa Indians on Lake Superior, in northern Wisconsin, had the misfortune to have an arm broken, which confined him to the house. About the same time his son, L. H. Wheeler, Jr., and others were hauling sleigh loads of fish from the lake through the woods to St. Paul. Part of the way trees had to be cut down to enable them to get through. Mr. Wheeler got caught by one of the falling trees and had a leg broken; he was carried back by his friends to his father's house in the Indian village of Odania.

While they were both convalescent, one having the use of his legs and the other the use of his arms, they managed between them to make a model of a windmill. After they were able to get around, they built a rough windmill. It was a rigid affair, without any arrangements about it to adjust itself to the wind. The first time the wind changed it blew the mill over. Not discouraged at this mishap, they hewed a pivot out of a log so that the wheel would adjust itself to the changes of the wind. This second mill was erected to work a pump, the whole arrangement of which was out of wood.

There is a poetic incident connected with this second mill which seemed at the time to be a harbinger of good luck. Blue birds built their nest in a recess in the pivot. When the young were hatched and ready to leave their nest, they all flew down into the sitting room of the missionary's house.

In 1867 Mr. Wheeler moved with his family to Beloit, Wis., and with but very little capital started to build windmills in a shanty



shown in the engraving, with the firms' name, L. H. Wheeler & Son. tacked on the roof. From this small beginning has grown the extensive works of the Eclipse Wind Engine Company. Without going into details of of the sizes of the different departments, their new works are all first-class, substantial buildings, and spread over seven acres of ground. In the busy season they employ over 300 hands. The machinery is run by a 150 horse-power engine, and since 1881 they have on an average used annually 1,200 tons of pig iron, wrought iron in proportion, and three million feet of lumber manufactured into windmills, tanks and railroad water supplies.

The Production of True Crank Shafts and Bearings.

BY HORACE SEE, PHILADELPHIA, PA.

A PAPER READ BEFORE THE CHICAGO MEETING OF MECHANICAL ENGINEERS.

It has been said, "of all parts of marine engines that which requires to be renewed most frequently is the crank shaft."*

This is no doubt principally due to the shaft being injured or broken by the strains † which come from either the want of truth in itself, or from the bearings being out of line.

In order to eliminate these strains, and leave none but what are derived directly from the piston, a standard of workmanship has been adopted which excludes all measurable errors.

To effect the desired improvement it is proposed to use a cylindrical truing mandrel or face plate, if it may be so called, of a length somewhat greater than that over the extreme ends of the main bearings, and of the same diameter as the journals of the shaft. In addition to this, for the built-up shaft, there is a set of special bearings corresponding in number and diameter with the journals of the crank shaft, and secured, with the capacity of longitudinal adjustment, upon a stout and truly level bed.

The fitting and finishing of a built-up crank shaft is as follows: The special bearings having been been bored out and properly secured upon the bed, are made true and in line axially by applying the mandrel to them, and correcting any irregularities which the mandrel as a face plate may develop.

The several sections of the shaft with the cranks shrunk on and keys forced in are next dropped into and secured in their correct position in the adjusting bearings. A portable boring bar and gear is then set parallel with the shaft, in bearings upon the bed, and the eyes of each pair of cranks are bored to receive the pin, which is then forced or shrunk in and keyed.

The main bearings of the engine are bored out and the mandrel dropped into them to detect errors, which are corrected, after which the shaft is tested and made true, if necessary, by dropping it into the main bearings, which are now used as an external cylindrical face plate, after which the couplings are corrected by facing them off with power or by hand, while the shaft is revolved in the main bearings.

As a final assurance against the possibility of the shaft and bearings being out of line when in operative position, the mandrel is again applied to the bearings after the line has been run through them and the bed plate securely fastened to the foundations. In the event of either of the bearings having been forced out of shape or position in screwing down, it is corrected by raising or lowering before the shaft is finally dropped into place.

The several operations before described refer more particularly to the case of a built-up crank shaft. When a solid shaft is to be dealt with, it is, after being turned, tested and made true with its own bearings after they have been perfected.

The practical result of following the above has been not only the ease with which the serious errors have been detected and kept out, but also the facility and certainty with which large, as well as small shafts, composed of one, two, and three pair of cranks, together with their bearings, have been produced of such perfect form and excellence that the surface of both journal and bearing is made up of numerous bearing points, equally distributed,* and lying close together.

Moreover, it has been possible with such a condition of truth, to run with very close adjustments, the clearances ranging from the one hundredth to the one hundred and twenty-fifth of an inch. There being no idle surface, this, also, has been done without heating or the use of water during even the first trial of the engine, and that with the full pressure of steam upon the piston. The wear, also, has been kept down to quite a small amount. Some 25,000 nautical miles have been run before re-adjustment has been necessary, and 135,000 before the wear of journal and bottom box combined has amounted to the one fiftieth of an inch.

The following, it may not be without interest to mention, are the names of some of the vessels fitted with shafts produced in this way: S. S. Mariposa, Alameda, San Pablo, H. F. Dimock, Eureka, El Paso, El Dorado, Philadelphia, and yacht Atalanta.

* On some of the Causes of Failure of Crank Shafts in Marine Engines, by J. T. Milton, Trans. Inst. Nav. Architects, 1879.

† Address to the Mechanical Science Section of the British Asso., by B. Baker, M. I. C. E., Pres. of Section, Aberdeen, 1885.

* On producing True Planes or Surfaces in Metals, by Jos. Whitworth, Trans. British Asso. for the Advancement of Science, Glasgow, 1840.

To Mould Kettles and Pans in Loam, With Full Instructions for Casting Bottom Up or Bottom Down.

BY S. BOLLAND.

Fig. 58 is a sectional elevation of an 8′ 0″ kettle, $1\frac{3}{4}$″ thick, showing the cope closed over core.

In commencing a job like this, let particular attention be paid to the selection of a foundation plate, making sure that it is strong enough to lift the core without springing. If the plate is plain, as shown at *A*, it should be at least 3″ thick; but should you have to make one, let it be after the design shown at *B*, and 2″ thick. The sweep first used forms the core, strikes the bottom of flange, also the seating or guide, and bearing for cope ring. Build the core with open, coarse mud, keeping the bricks well apart to allow the air to pass freely from the surface. Use half bricks on the upper course, crossing the joints all along, and putting in a tie course here and there, as shown at *C*. After the bricks are all laid, clean them off well, and scrape down into the joints. This will help to hold the loam firmly to the bricks. Use your loam soft, rubbing it well on the bricks, and sweeping off as you go around. For the finishing or skimming coat it is best to use the same loam, sifted fine. Your loam being hard enough, take off the thickness, strip, and strike on the thickness, which is done thus: Have some old sand, at the regular green sand temper, sifted fine; start at the bottom, ramming it on hard with your hand, using the sweep carefully so as not to drag down the sand. After you have struck on the thickness of sand, dampen a little and slick all over, leaving it clear of the sweep about $\frac{1}{16}$″, taking care to trim the corner of flange by pressing it down all around with your trowel, so as to insure a sharp edge when you skin up.

It is well to make sure of enough skinning loam before you commence, as there is no time to be mixing more (should you be short) after you have once commenced, on account of the old sand absorbing the water so quick and leaving the surface hard; it must therefore be finished at the first pass round, if possible.

When the thickness is hard enough to work on, oil all over and throw on parting sand. You now set on the cope ring, and commence to build the cope, as shown. It will be observed that two ways of building the cope are shown. One with building rings, and the other all brick. By placing rings, as shown at *D*, *E* and *F*, and packing between them, as seen at *G* and *H*, you can bind down the mould as soon as it is closed, packing under the cross at *I* and *J*. This I consider the best and safest plan.

But you can build your mould, as shown, without rings, in which case more care is required in the ramming. When you have rammed the mould as high as shown at *D*, a plate must be bedded on the sand, taking care that it is good and solid underneath. Packing must be placed on this plate in suitable places for wedging under the cross. After ramming a little above the top, another plate must be bedded down clear of the runners, and both firmly bound down with the cross or binders. The gates and riser are shown. The riser being on the top, a sufficient number of $\frac{3}{4}$″ runners, to run the mould full at a lively rate, must be arranged around it, forming a circle about 30″ diameter.

Do not keep the riser open when you cast, but after making your basin for the flow-off, fill it with soft straw or hay, and place over the hay a dry brick or two, or a piece of core to keep it down. This answers a good purpose, inasmuch as it does not prevent the gas from escaping from the mould; but it does prevent that rush of expanded air which, when the riser is left open, so often damages the crown of the kettle.

Another important matter is to carry off the gas from underneath a hollow mould. I have tried many ways, but prefer the one of making a gutter or trench from the center of the pit to the outside, in two places, opposite each other if possible. Let the gutter run on a gentle slope to the center. Should the mould be rammed in the pit, connect these gutters with pipes leading to the top, and just before you cast pour down a little iron so as to reach the center. This warms and expands the air inside and creates a draft, along which the gas from the core will travel safely.

One great evil of which I would warn moulders is the placing of a great quantity of shavings and wood in the trench and along the bottom.

These taking fire suddenly throw such a sudden heat up to the brickwork as to expand the core and loosen the loam. The consequence is a badly seamed core; or, as I have seen more than once, the casting is lost altogether.

When lugs, eyes, brackets, etc., are to be cast on the outside they may, in many instances, be rammed up in a core and the core built in at the proper place; but if the pattern must be bricked in the cope, let the thickness-sweep be nicked at the height required; this leaves a mark all round, and it is then easy to set off to right position, according to drawing.

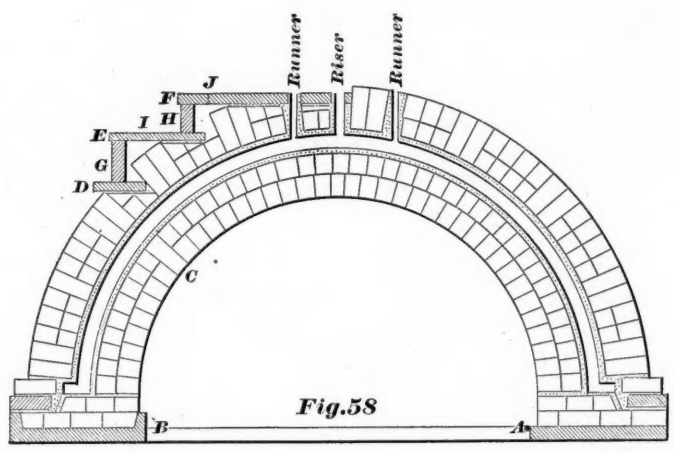


Fig. 58

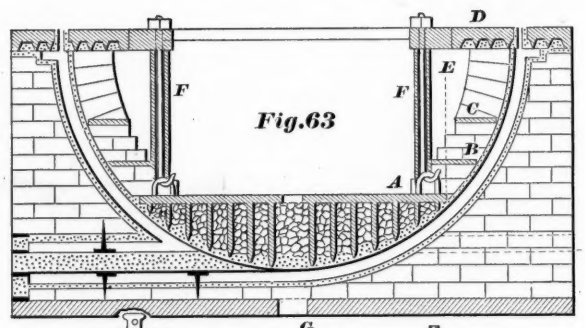


Fig. 63

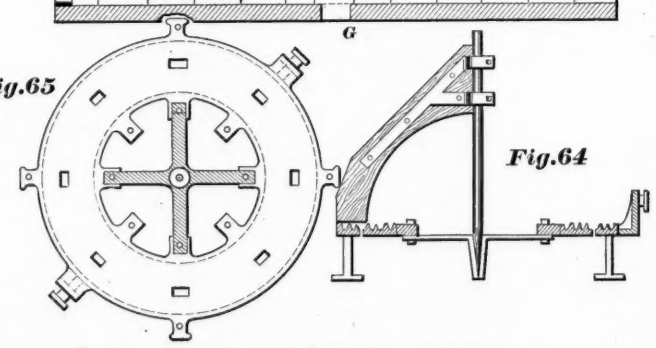


Fig. 65

Fig. 64

MOULDING KETTLES AND PANS IN LOAM.

TO MAKE A KETTLE BOTTOM DOWN.

Fig. 63 is a sectional elevation of lead kettle at half its diameter, and shows at a glance the method of building cope and core. The branch core is seen secured by chaplets, with core cake closed on at ends. The engraving represents a kettle 7′ 6″ diameter, 3′ 9″ deep. A strong foundation is required for this job, as a great weight is to be carried, the brickwork, as shown, reaching to the outside all the way up. The first sweep used in this case forms the outside, on which (when hard enough) the thickness is swept. Let the brickwork be very open, and use plenty of cinders, leading a vent to the outside from every course. This serves to carry off the steam when drying, as well as to give vent to the gas when cast.

At *A* is seen the bottom plate of core, which, when made, care must be taken in pushing in the prickers, so as to have them the correct depth and position. The staples must be set so as to come directly under the inside lug of covering plate, as shown. This plate, when made, must be turned over, and the prickers packed with cinders to about 3″ from the point, loam and brick filling the rest. You now dry this, after which it can be cleaned off well, so that no soot clings to it, and if (as stated above) care has been taken to keep the form of bottom, it will be easily bedded on about $\frac{3}{4}$″ of soft loam, which must be spread on the thickness. Lay your bricks as seen until you come to plate *B*. A glance at the engraving will be sufficient to show why the rings *B* and *C* are used. The broken line *E* shows that most of the core to be built hangs past the plate *A*. The inner edge of ring *B*, being supported by plate *A*, carries the brickwork up to ring *C*, which, being supported by ring *B*, carries you past the curve, where the core is almost straight, and there is no need for further support. These rings can be cast thin, and bedded down on soft mud. A plan of top covering plate is shown at Fig. 65, leaving out the four lugs to which center is attached, and the two swivels which are shown for another purpose, as will be seen further on. The only lugs required in this case are the four inside, for bolting core up to, and the four outside for lifting.

Two methods are suggested for the top plate. One is to dry a thickness of loam in the pricker, and bed down on soft loam on the joint, and over the brickwork of core at the same time; this is the best plan, as it insures absolute correctness of fit. The other plan is to strike top of core level with outside joint, and after the covering plate is swept with the spindle and dried, it is turned over and laid on. Let the covering plate be cast strong. The one shown has flanges cast on both inner and outer edges, and makes a good plate out of the same quality of iron which, if cast into a plain plate, would be useless for the job. Before screwing bottom and top together, let studs be set in between, as shown at *F*, and take care they are not too tight before you screw up, as you require to have a good grip on the mould. This core may be finished overhead and set into the oven in the same position, saving the trouble of rolling over.

The method described serves well where the kettle has branches or lugs cast on, and when the order does not exceed one or two. But should there be an order of plain kettles to make, the cope may remain rammed in the pit after the first one is cast, by securing a center to the bottom plate at *G*, sweeping it up where it laps, and drying with a good fire-pan.

The plan for top plate in this case is seen at Fig. 65, and includes, in addition to the lugs for bolting core to, four others, to which a center must be bolted, as shown, and swivels for turning over by.

Fig. 64 shows top plate with center attached, set on stands, with spindle and core-sweep in place. This center remains a fixture. Let the core be built after the manner shown at Fig. 63, and firmly bolted. If strict attention is paid to the bolts at every cast and the core lifted from the casting before the shrinkage comes on, you can make a great number of kettles from these moulds, and because with the fixed centers you have nothing to do but clean off well, and sweep off at once, they can be made very rapidly and cheaply. In fact, it is neither more nor less than an extemporized casing.

Good kettles can also be made from a core made in this manner, substituting a green-sand bottom for the one in loam. But it would not be well to drop the iron from the top in this case; better to set one or more draw runners at the bottom, as shown at broken lines, Fig. 63.

Injustice of Tax Exemptions.

Amendments have been made to the Constitutions of Maine and New Hampshire authorizing towns and cities to exempt new manufactories from taxation by majority of popular vote. Louisiana also has such a provision in her Constitution. Fifteen towns in New Hampshire voted this spring to grant the benefits of the exemption. We have always contended that the exemption policy is unjust. All establishments should stand equal before the law. If one is excused from taxes, all others that confer like public benefit should be also excused. Where a manufactory of a certain article is established in a town and pays taxes, if another factory of the same kind is attracted to the town by exemption from taxes, the latter certainly has an undue advantage over the former. A private bonus is something the law cannot reach, but the old factory should not be forcibly taxed to help the new. The exemption is no doubt a great inducement for new industries to locate in a town, but we feel assured that it will soon become an inducement for the old industries, that pay taxes, to move away. Concerns that pay taxes have an interest in keeping down public expenditures. Those exempt from taxes would not be much interested in public extravagance. In towns where a few pay taxes and the others are free there is likely to be an excess of so-called "public improvements," and taxes will be high. The more familiar the people become with the exemption plan the more apparent will be its injustice.

The railroads of the United States gives employment to 650,000 people.

If everybody should boycott everybody who doesn't do as he wants him to, wouldn't there be a pretty how-d'ye-do?—or would there be any how-d'ye-do at all?—*Chicago Journal.*

The Grand Rapids *Telegram-Herald* says: "The late strikers at Chicago ought to take a day to 'hunt anarchists. If it hadn't been for these hyenas, the strike might have amounted to something."

Consul Tanner at Chemnitz, Saxony, reports that the high price of wooden railroad ties and telegraph poles has led to the substitution of iron and steel for these purposes. The number of iron and steel cross-ties on German roads increased from 1,418,241 in 1880-81 to 5,440,772 in 1883-84. The same percentage of iron telegraph poles replacing those of wood might be shown. The consul says: "The change is not taking place because of any special merit of iron or steel as cross-ties, but solely as a matter of economy."

Modern Locomotive Construction.

BY J. G. A. MEYER.

TWENTY-FIRST PAPER.

THE WOOTTEN FIRE-BOX.

Figs. 111, 112 and 113 represent a locomotive fire-box, which is known by the name of the Wootten fire-box. Fig. 111 represents the end view, Fig. 112 the side view, and Fig. 113 the plan of the fire-box. Since we intend only to show how to lay out the outside sheet marked *A*, all other details of the fire-box have been omitted. In connection with the laying out of the sheet *A*, or, geometrically speaking, in connection with the development of the surface *A*, the following preliminary remarks will be interesting and instructive to the reader. It is generally the custom to use three sheets, as *C D E*, shown in Fig 114, instead of one sheet *A*, shown in Fig. 111. In this paper we will assume the outside of fire-box to be made of one sheet, because this will be of a greater benefit to the reader, for when a person can lay out a sheet, or develop a surface similar to *A*, it will be to him an easy matter to lay out the outside of a fire-box when it is made of three sheets.

In the plan, Fig. 113, the lines a_3 c_3, and a_4 c_4 represent the sides a b and a_2 b_2 in Fig. 111; these sides are also represented by the parallelogram a b c d, Fig. 112. Again, the lines a_3 c_3 and a_4 c_4, in Fig. 113, are drawn parallel, which indicates that the sides of the fire-box are parallel; or, in other words, it indicates that the width of the fire-box is the same at both ends. Now notice the sheet *A*, when it is rolled to its proper form, contains three distinct kinds of surfaces. First, it contains, in Fig. 111, a flat surface from a to b, and another flat surface from a_2 to b_2. Second, it contains a cylindrical surface from a to e, and another from a_2 to e_2; and, lastly, from e to e_2 is a warped surface. Here the question arises, how can we determine the extent of each surface? Or, in other words, how much of the sheet will be straight surfaces, cylindrical surfaces, and how much of the sheet will be a warped surface? The extent of these surfaces can be determined according to the following method:

First. To find the extent of the straight surfaces, let the point g, Fig. 111, represent the center from which the arc a e has been drawn, and the point g_2 the center for the arc a_2 e_2. Through the centers g and g_2 draw a straight line a a_2, then that part of the sheet lying between a and b, and also that between a_2 and b_2 will be straight surfaces.

Second. To find the extent of the cylindrical surfaces, let the point f represent the center from which the arc e_2 k e has been drawn; through the centers f and g draw a straight line f e: also through the centers f and g_2 draw a straight line f e_2; then that part of the sheet lying between the points a and e, and also that lying between the points a_2 and e_2 will be cylindrical surfaces. Lastly, that portion of the sheet lying between the points e and e_2 will be a warped surface.

The rule here given for finding the extent of the cylindrical surfaces holds true only when the angle h e g is a right angle, and also when it is less than a right angle; or, in other words, when the straight line e h is square with the line e g, and also when the former is leaning towards the latter. In cases in which the angle h e g is greater than a right angle, as shown in Fig. 115, we must draw through the center g a straight line g e perpendicular to the line h e, then the portion of the sheet lying between the points a and e will be a cylindrical surface; and in a similar manner we find the extent of the cylindrical surface on the other side of the figure. The warped surface will lie between the points e and e_2.

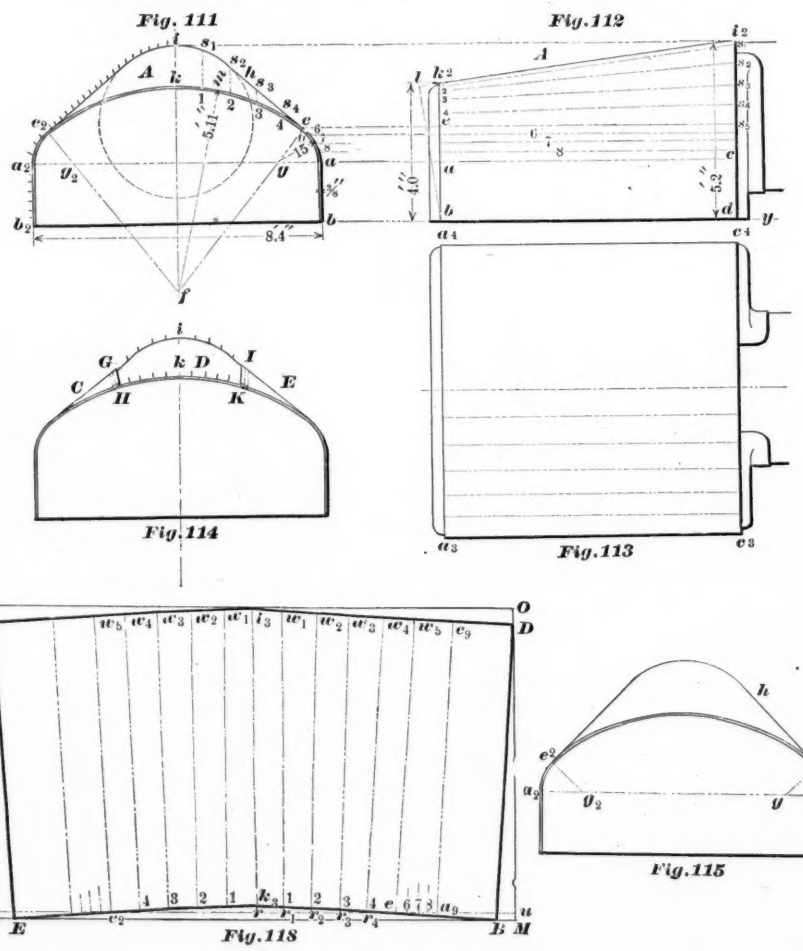
The line a c, Fig. 112, represents a line drawn on the outside of the fire-box sheet, say a chalk line; it also represents an imaginary line drawn through the point g, in Fig. 111, or we may say that the line a c, Fig. 112, represents the axis of a cylinder of which g e a, Fig. 111, is a portion. All lines drawn on the surface of a cylinder parallel to its axis, are straight lines and parallel to each other; hence, if we divide the arc a e, Fig. 111, into any number of equal parts, say four, and through each point of division as 6, 7 and 8, a line be drawn parallel to the axis of the cylinder then will these lines be straight and parallel to each other, as shown in Fig. 112. The line i_2 k_2 in Fig. 112 is a straight line, and thsi same line is represented in Fig. 111 by the straight line i k. If now we assume that on the warped surface of the fire-box a number of lines, as $1s_1$, $2s_2$, $3s_3$, be drawn parallel to i k, then these lines in Fig. 111 will appear to be straight lines, but if we lay a straight edge upon these lines, we will find that they are not straight lines, they are curved lines, and therefore the line $1s_1$, $2s_2$, $3s_3$, Fig. 112, should be curved lines, but for the sake of simplicity we have shown them to be straight lines. This will not affect the shape of the sheet to any appreciable extent. In ordering the material for a boiler it is generally the custom to order for the fire-box, sheets whose edges are straight and square with each other. If there is no time to lay out the sheet as shown in Fig. 118, then the length and breadth of this sheet can be found approximately in the following manner:

First, to find the breadth.

In Fig. 112 produce the line i_2 k_2 toward l, through the point b (the bottom corner of the fire-box) draw a line perpendicular to i_2 k_2, and intersecting the latter in the point l; the distance between the points i_2 and l will be the width of the sheet.

Second, to find the length.

The length of the sheet will be equal to the number of inches which the line b a e i e_2 a_2 b_2, Fig. 111, contains, and can be found by dividing this line into any number of equal parts, and then multiplying the number of parts by the length of one part. Thus, for instance, divide the line i e_2 a_2 b_2 into 28 equal parts, then if each part measures 3 inches, the length from i to b_2 will be $28 \times 3'' = 84''$. But the same length is required for the other side of the fire-box, hence the total length of the sheet will be $84 + 84 = 168$ inches. A sheet whose dimensions have been found according to the foregoing methods will be somewhat too large, and therefore a waste of material which might have been avoided will be the result, yet this extra waste of material will only be a small amount. When it is desirable to order a sheet in which the waste of material shall be as small as possible, then the best method to adopt will be to find the correct outline of the sheet as B k_3 E D i_3 F in Fig. 118, by laying it out on paper to a scale (how to do this will be presently explained), and around this draw the parallelogram M N O P, then the length and breadth of this parallelogram will be the length and breadth of the sheet required. In this case the only amount of material that will be wasted is that between the straight line M N and the line B k_3 E, and also that between straight line O P and the line D i_3 F, and a small piece in the form of a triangle at each end.



Railroad Shop Notes.

The West Shore Railroad shops at Frankfort, N. Y., are nearly new, having been running but little over one year.

The shops are arranged for convenience, being all grouped around a central turn-table. This disposition gives a scattered, straggling impression to the casual beholder, but a second look shows "method in the disorder."

No transfer table is needed, owing to the central turn-table, and also to a track which extends around the shops and enters at the opposite end from which the turn-table track comes in.

All the shops are fitted with a liberal supply of the best tools to be had.

At present 195 locomotives are kept in repair at these shops, 14 being in for repairs when we called last week.

Ten of these locomotives are being thoroughly overhauled, three are up for light repair, and one is having cylinders bored.

The most striking feature of this shop (steam hammer excepted) is an overhead raveler, by the Phœnix Iron Works. It has at span of 50 feet, and is 300 feet long. It is driven by a square shaft, which runs the whole length of shop. This shaft is supported by half boxes at regular intervals. When the traveler arrives at one of these supports, the support is lowered automatically, giving the traveler free passage.

The shaft (300 feet long) was welded up on the spot, the welds planed down, and the whole hoisted into place.

When first put up, the shaft was kept well wiped up, but proved to be such a nuisance when the sun shone upon it that dirt and grease were allowed to settle and stay upon it.

There being two travelers, it is only necessary to slip a yoke under each end of a locomotive and raise it bodily from the tracks. It can be transferred from track to track while thus raised, or may be carried from one end of shop to the other without trouble or delay.

The foundry building is large, well lighted, and makes one of the best shops in the country. Twenty-eight men are employed at present, and with facilities for three times that number.

Two 60-inch cupolas are set up in the foundry, but only one has yet been put at work.

These cupolas are lined to 48" in diameter, and take the blast in six places. They have a wind jacket entirely around them.

The tuyeres contain the arrangement for turning down the air as it enters the cupola. This point is the feature upon which the claim of superiority of this cupola is based.

A Baker pressure blower driven by a Wilbraham vertical engine supplies the blast.

During the "coke famine," which was induced by the recent labor troubles, coal was used entirely for melting, and it was found necessary to increase the pressure from 7 ounces for coke to 15 ounces for the coal, which was of poor quality.

The foundry is fitted with a small overhead hand traveler, which is effective but slow.

A fine large oven for baking dry sand molds is reached by a small railroad track, which is also continued through the core room to core oven.

Six turn-tables in the track will allow communication with different parts of the floor by means of tracks which are not yet completed.

A brass shop, with provision for six furnaces, is connected with the foundry. The furnaces are set level with floor, the firing being attended to from a pit dug for that purpose.

A paint shop covers three tracks, and is in a building which will be used for a boiler shop when the plant is fully established. A small turn-table, traveling crane, and a place for hydraulic riveter are provided for in this building.

The steam used in all the shops is generated in a house at some distance from the other buildings, but which eventually will be covered by a wing of the foundry.

The machine shop is driven by a small temporary engine, and a 12-inch Westinghouse, which runs satisfactorily. Another Westinghouse engine is to be put in some time in the future.

All the buildings are so planned that they may be enlarged by extending the buildings from the turn-table outward. The machine shops may receive additions one-quarter mile long, if necessary, before the company becomes crowded for room.

The foreman of foundry avoids trouble from rats by making cores so "poor" that rats won't look at them. He mixes in rye flour in proportion of 1 to 15, and uses no beer, molasses, or other ingredients except water. He says the rats give up the cores as a bad job, yet specimen cores picked up haphazard seemed to be good enough for any work.

Three hundred and seventy men are at present on duty in these shops. The locomotive check board shows but five engines on the "fair condition" division, or as needing repairs. All others are either "good" or in the shops.

Schenectady Locomotive Works.

At the Schenectady Locomotive Works no "regular" work is being done, the entire force of help being employed on "special" or ordered work from other roads, for which plans and specifications are furnished.

Extensive alterations were contemplated, and arrangements made for the same, but owing to labor troubles in the Southwest and in other places, the changes were deferred, although everything was ready, except signing the contract for the new buildings.

A large blacksmith's shop was the contemplated addition. The present shop, although large, is not large enough, and is not convenient as desired.

The transfer table between the shops is over 500 feet long, and is driven by a hoisting engine, which is maintained upon the table.

When an engine or car is to be transferred, the table is run to the right track, a cable attached to the engine, and then a turn taken around the hoisting drum, when the engine or car is easily pulled on the transfer table.

When the engine is to be unloaded, the cable is given a half turn over a snatch block, which hooks into an eyebolt in shop floor, and the hoisting engine pulls engine off, precisely as it was drawn on to the table.

A three-head slotter is working on frames beside a two-head slotter. The three-head tool is from Leeds, England. It looks stout, heavy and massive to such a degree that the American slotter looked almost fairy-like in its proportions; yet, when heavy work is to be done, the Leeds tool will fail. It will chatter; the wrist-pin for adjusting length of stroke will slip in the slotted disc, and needs to be held by a block driven in behind the wrist-pin block.

The American tool resists all work put upon it, and we were informed that with but two heads it has done nearly as much work as the English tool with three heads. "Every pound of metal in that American tool is just where it is worth the most," said our guide; "there is no spring to that tool, and it never fails."

A three-spindle drill for drilling frames is fitted with a neat rig for supplying soda water to the three drills.

An arm bracket is bolted to the drill frame, and fitted with a short shaft and crank disk to drive a small pump placed under the machine. A pulley on the crank-shaft is belted to a small pulley placed upon the horizontal shaft which drives the three spindles.

The pump is placed in a tank, holding about five gallons. A tank exactly the same size, and cast from the same pattern, was placed on top of the drill, and connected to pump with steam pipe

Three nipples were tapped into bottom of upper tank, globe valves put on, and three pieces of rubber tubing served to carry the soda water to the drills.

Before this device was applied the drill man had his hands more than full in tending the three drills. His task is much easier now. Beside securing much more work, the liberal supply of cold soda water carries off the heat so fast that the drills can be run with increased speed.

It seems that the above scheme might be carried farther with good results. A larger tank might be used, a larger pump put in, and soda water supplied to all machines needing it.

FIG. 18.—WORM AND WORM WHEEL.

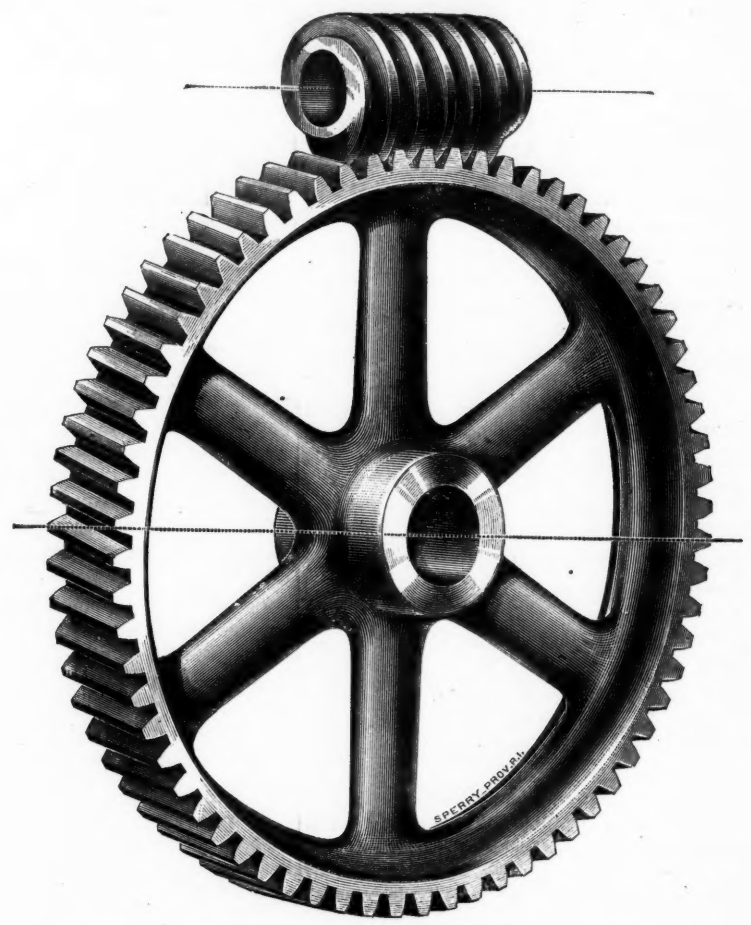
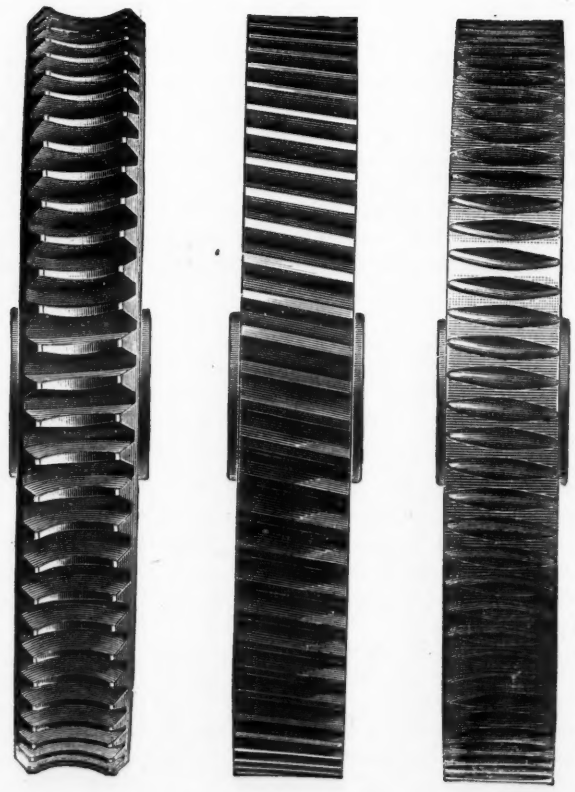


FIG. 24.—WORM WHEEL WITH DOUBLE THREADED WORM.

FIG. 25.—WORM AND WORM WHEEL FOR GEAR CUTTING ENGINE.



FIGS. 26, 27 AND 28.

No more soda water is used than can be put into one tank, thus making it impossible to run the tanks over when the three valves chanced to be closed.

The soda water is caught in pans as it drips from the work, and runs through a strainer to the lower tank, when it is pumped up to be used again.

It is the cleanest method in use, as there is no chance of upsetting pail or dish of soda-water, and it can be put directly where needed, in a small, continuous quantity.

A number of boilers with the Buchanan fire-box are in process of construction at these works, and we were informed that it was to be adopted by them. The Buchanan fire-box was illustrated in the AMERICAN MACHINIST, Oct. 18, 1884.

Worm Wheels.

In our issue of May 30, 1885, we published, from the advance sheets of "Practical Treatise on Gearing," by the Brown & Sharpe Manufacturing Company, a method of sizing worm-wheels. From the completed work we give herewith further illustration of the general subject of worm gears:

"The teeth of the wheel are first cut as nearly to the finished form as practicable; the hob and worm-wheel are mounted upon shafts and hob placed in mesh as in Fig. 18. The hob is now made to rotate, and is dropped deeper into the wheel at each revolution of the wheel, until teeth are finished. The hob generally drives the worm-wheel during this operation. The Universal Milling Machine is very convenient for doing this work, and with it the distance between axes of worm and wheel can readily be noted. Where a great many wheels are manufactured, special machines have been made for driving wheels independent of hob. The object of hobbing a wheel is to get more bearing surface of the teeth upon worm-thread. The worm-wheels, Figs. 18 and 26, were hobbed. By hobbing we produce outline of teeth something like the thread of a nut.

"Some mechanics prefer to make dividing wheels in two parts, joined in a plain perpendicular to axis, hob teeth; then turn one part round upon the other, match teeth and fasten parts together in the new position, and hob again with a view to eliminate errors.

"With an accurate cutting engine we have found wheels like Figs. 25 and 28, not hobbed, every way satisfactory. Dividing wheels of 2 feet diameter and less are generally made without arms, the part between hub and rim being a solid web. As to the different wheels, Figs. 26, 27 and 28, when worm is in right position at the start, the life-time of Fig. 26, under heavy and continuous work, will be the longest.

"Fig. 27 can be run in mesh with a gear or a rack as well as with a worm. At the start the contact of teeth in this wheel upon worm-thread is in points only; yet such wheels have been many years successfully used in elevators.

"Fig. 28 is a neat-looking wheel. In gear-cutting engines where the workman has occasion to turn the work spindle by hand, it is not so rough to take hold of as Figs. 26 and 27. The teeth are less liable to injury than the teeth of Figs. 26 and 27."

The *Modern Miller* argues that ropes will very generally supersede belts for driving in flouring mills, within a few years.

When the duplication of parts of machinery began to be practiced it was very generally assumed that it was applicable only to large shops. But the present state of the arts in this respect permits its successful use by small shops about as well as by large ones. Gauges and many of the tools and appliances used in duplication can be had from manufacturers who have special arrangements for doing this kind of work, making it a question whether work should be done in any machine shop except upon the plan of duplication.

LETTERS FROM PRACTICAL MEN.

Hydraulic Presses.

Editor American Machinist:

In a translation of a certain French work upon natural philosophy, in describing the construction and action of the hydraulic press, the following occurs:

"The hydraulic press is very extensively employed in the arts. It is of great power, and may be constructed to give pressures of two or three hundred tons."

The translation is by an "F.R.S." and bears date of 1878. Well, we should be thankful for small favors and —— presses.

It is within the personal knowledge of the writer, that pressures of more than two thousand tons are obtained, and it is probable that presses of great power are in use.

I will say nothing of the construction here, further than to point out a common defect, and suggest a remedy for the same.

As usually constructed and operated, there is no protection of the piston, outside of the cylinder. Particles of sand or some hard substance will work into the packing, making slight scratches upon surface of piston. If worked under a heavy pressure, say two thousand pounds per square inch, the fluid will be forced through these little channels, and in time, enlarge them until the piston is ruined.

A canvas covering, cylindrical in form, and attached to the top of piston, or the platen, if one be used, will keep the dirt from it, thereby saving expense and inconvenience.

In a certain shop a press of one thousand tons capacity was used, the piston of which had grooves in its surface about $\frac{4}{100}''$ in depth. It had been the custom to endure the evil as long as possible, and then put in a new piston.

Thinking matters could be no worse, a man was set at work with a file to remove the grooves, leaving the surface smooth, but not true. Two hours did it, and the piston was as good as new—not a drop of water appearing above the packing when in use.

The two hours work saved, approximately, one hundred dollars.

W. G. RICHARDS.

Seth Boyden's Inventions.

Editor American Machinist:

Kindly permit me space to comment on a recent article by Mr. G. E. Sellers—20th paper—in which he devotes it all to the late Seth Boyden, of Newark.

Mr. Sellers doubtless is a pretty old man, and I presume that is an excuse for his having got dates mixed up and facts wrong.

The colored drawing of the old locomotive Essex was not the original, as he supposes, but a copy from it. The original drawing, made by my father, I have in my possession, and was made by him just after the Essex was finished in 1838.

Mr. Sellers says he "may throw some light" on the subject, and starts off by saying the Essex was the first one built. As a matter of correct history, the Essex was the second, and the Orange was the first.

This fact will have greater significance as we proceed.

Mr. Sellers says, previous to Mr. Boyden's taking a contract for these locomotives, he came to Philadelphia, "bringing with him a movable card model of his proposed valve gear, in which he took the motion from the crosshead."

This form of valve gear had no existence till after the locomotive Orange was accepted and run by the Morris and Essex Railroad Company. The valve gear designed and put on to the Orange was driven by a supplementary crank, its center setting back from the main crank-pin center in the driving wheels sufficiently to reduce the travel to the degree desired. From this pin ran a light connecting-rod, with an overhang pin, or wrist, set solid into its outer end.

This wrist was caused to engage in simply a recess at the extremities of an oval-shaped, flanged disc. These flanges, with the sockets at the extremity of oval disc, were possibly the first conception of the V hooks used by Rogers, about 1839.

This oval disc was cast with a trunnion, on the inner end of which was fixed a rocker arm, which worked the main slide valve direct.

To reverse the engine, the before mentioned light connecting-rod was thrown clear up or clear down, to engage either end of oval disc.

A very good sketch of this valve gear was furnished me some time ago, by one of the mechanics mentioned in Mr. Sellers' article, who worked upon the Orange and Essex, Mr. P. I. Perrin, now agent and treasurer of the Taunton Locomotive Manufacturing Company.

It will be observed that this V gear had no mid gear position, and all the cut-off contemplated was due to lap of valve, and Mr. Sellers' recollection about a paper model of cut-off valve gear for these engines is not tenable, as will appear further along.

It was found that this V gear was very defective, because the flanges on edge of oval disc would not retain the wrist, and when that happened, the engineer lost control of his engine. After all this experimenting had taken place, the oval disc was discarded, and the first form of link ever used on a locomotive was adopted. Still this new V gear did not contemplate a cut-off that Mr. Sellers tells us about.

Mr. Sellers further says "it was in a measure anticipating the present link motion."

I don't think any one is justified in qualifying this matter one iota.

The attachment subsequently put on to the Orange and Essex was what is known as a closed link—nothing more, nothing less, and it was found successful; so much so that every locomotive built at this day has a link in some form.

Now a word about that "adjustable cut-off" Mr. Sellers speaks of.

It is astoundingly odd that, if Mr. Boyden ever contemplated using an adjustable cut-off on his locomotives, not a living soul about his works or in his family ever heard of it till they read it in Mr. Seller's article, and quite as astounding to presume Mr. Boyden should go to Philadelphia and exhibit it to his strongest rival contractors before obtaining the locomotive order.

Seth Boyden invented but one automatic or adjustable cut-off for steam engines, and, had it been controlled by most any one except Mr. Boyden, there would have been thousands of dollars realized from it. His original receipt for a patent application, dated March 1st, 1845, with the original drawing and specifications, lies now before me.

It will be observed that this date is nearly ten years after the time of which Mr. Sellers speaks.

The first and only claim reads: "What I claim as my invention, and desire to secure by letters patent, is connecting the governors of steam engines to a cut-off valve, so that the steam is let into the cylinder at full pressure, and shut off by the aid of a governor at any point the variation of labor may require, leaving the steam to finish its work by expanding until the piston reaches its returning point."

There is nothing authentic on record to show that this invention laid dormant for ten years before an application was made for a patent, and there are incidents connected with it that show that Mr. Boyden applied for a patent at once.

It can be said of this invention that it was a very great stride toward perfecting steam-engine economy, and a great number of engines were built upon the principle and design of Mr. Boyden, and with every individual one it proved a success.

The original contract for the first engine ever built by Mr. Boyden with this automatic cut-off lies before me, and is dated February 13th, 1845, and it was during the building of this engine that he applied for a patent. The cylinder contracted for was a $12'' \times 24''$; the bed of the common box pattern, known as the Boyden bed-plate. The contract referred to was rigidly drawn, and everything was furnished accordingly. The iron for both the cylinder and bed was beautiful metal, such as is rarely put into bed-plates or cylinders at the present day, and resembled closely what is known as gun metal, produced at South Boston Foundry.

I had the pleasure of doing some work on this same engine a number of years ago, in the replacing the old 12" cylinder with a larger one, and from the substantial manner in which Mr. Boyden done his work it was necessary to cut and carve considerably to make the change, and the beautiful character of the metal was then remarked upon.

I will now quote from Mr. Sellers' article, in which he says Mr. Boyden had been to Messrs. Vail & Son, Morristown, N. J., to inquire about tires.

Well, now, that is possible, but we think not probable, except as a matter of curiosity on his part. It was contemplated by Mr. Boyden from the start to make cast-iron wheels, which he did, they being $53\frac{1}{2}''$ diameter and nicely turned, and fitted to a straight axle turned the whole length.

If Mr. Boyden "had made drawings to use Baldwin's half crank," as Mr. Sellers says, why should not some one individual, who was intimately associated with Mr. Boyden in his work at that time, now remember something about it, whereas they one and all say they never heard of such contemplation on the part of Mr. Boyden, and that the straight axle was, first and last, intended as a new departure from anything they were familiar with at that day, and all their plans were arranged accordingly.

Permit me to quote from a letter I have received from Cyrus Currier, one of the mechanics intimately associated with Mr. Boyden's locomotive enterprise. He says: "Nowhere can I find, either in books, writings, drawings, or talking with old mechanics, one particle of evidence to destroy my confidence and belief that Mr. Boyden was the first one to put in the straight axle to the locomotive as applied to the present form of engine, also the link motion. Mr. Sellers to the contrary, notwithstanding.

The foregoing is only an echo from all those familiar with the labors of Mr. Boyden at that early time, and I will also say the language of Mr. Currier is very mild indeed compared to some I have received from others on the same subject.

We will accept as fact, for the sake of argument, that Mr. Boyden did visit Mr. Vail at Morristown about this time, but those who know Mr. Boyden personally could never be made to believe he went there or anywhere else to gather information about what he had to construct, much less unbosom himself to others and tell what he was going to do before he had done it, and especially to Mr. Stephen Vail, who was then a director in the M. & E. R. R., and father to George Vail, a member of the firm of Baldwin & Co., Philadelphia.

Mr. Boyden, as the historian well knows, had many strong characteristics, and self-sufficiency was one of his strongest, and for him to consult others about his business was never thought of.

The locomotive Orange was ready for delivery some time before accepted by the railroad company, from the fact that a story had been circulated by the crank-axle people that the engine would "jump the track" on account of the cylinders being so nearly horizontal and connected to the outside of driving wheels.

A committee of experts were appointed to examine and report; among those experts was George Vail, of the Baldwin Locomotive Works, Philadelphia, Stephen Vail, his father, Mr. Timothy Smith, superintendent of the N.J. R. R. and Transportation Co., and others.

It was Timothy Smith who remarked that if the locomotive jumped the track it would break itself all to pieces, but Mr. Obadiah Boyden who was present at the trial for steadiness tells me that not a remark was made by anyone to indicate that they had ever seen or heard of a straight axle locomotive before with outside connections, as designed by Mr. Boyden for this engine.

Now to refer to Mr. Sellers' last paragraph he says: "If Mr. Boyden was now living he would be the last man to claim outside connected engines as his system."

It is unfortunate, to say the least, that Mr. Sellers makes this remark sixteen years after Mr. Boyden's death, when, as a matter of fact, the claim of being the originator of the straight axle, as applied to anything like a modern constructed locomotive, has been made something like two dozen times on different occasions, and it now looks to us as if this claim of Mr. Sellers' comes, at this late day, with rather poor taste and void of all grace.

I will quote a few lines from an article written by Seth Boyden himself:

"My first improvement in stationary steam engines was the cast-iron frame or bed, my next was the introduction of the straight axle to the locomotive in place of the crank, which is now universally used, but my greatest invention in the steam engine was the cut-off in place of the throttle valve, and connecting the cut-off and the governor together. I want to remark that it is not common to employ a governor on a locomotive, which would have been necessary for Mr. Boyden to have done had he contemplated adopting this one and only cut-off to the locomotive.

I think I have shown conclusively that Mr. Sellers was not justified in the least in the remark he makes in the last paragraph to his twentieth paper, and I submit to your readers for judgment.

Now let me pass from the locomotive to to another subject, scarcely less important, discussed by Mr. Sellers. That of patent leather and leather splitting.

A reasonable interpretation by the general reader of what Mr. Sellers says on this subject, would be that Mr. Boyden, about to introduce his patent leather, went to Philadelphia to see if a new industry was being introduced in the shape of split leather, which would affect his business. This interpretation is confirmed in Mr. Sellers' next paragraph.

Without in the least detracting from the endeavor of Mr. Sellers' father to split leather, let me give a few facts to show that Seth Boyden was an inventor of leather splitting machines many years before he went to Philadelphia, and that it was not a new industry with the Boydens, but rather an old one.

During the war of 1812 Seth Boyden invented a machine for splitting leather, and carried on the business of leather splitting in his native town of Foxboro, Mass., supplying the pocket-book manufacturers and bookbinders, etc.

In July, 1815, Mr. Boyden, with his brother, Alexander, removed to Newark, N. J., where they continued the same business for about two years under the firm name of S. & A. Boyden, calf and sheep skin splitters.

In justice to a Mr. Gathwaitte, of Newark, the last part of Mr. Sellers' second paragraph on this subject should be corrected.

Mr. S. says: "It was not many months before he (Mr. Boyden) sent specimens * * * all beautifully japanned, etc."

Now, it is well known that Mr. Boyden did not make any split leather at that time, and where he could have got the skin there is nothing to show, for the first machine for splitting heavy leather was made by Mr. Gathwaitte in 1836, two years after Mr. Sellers' father died.

I regret to be called upon to correct an article of one of your contributors, but the friends of the great inventor cannot permit so many and important errors to exist. Nor do we believe you would willingly be a party to those errors, therefore I am obliged to send you a rather lengthy article.

O. C. WOOLSON.

Stamford, Conn.

A Substitute for Parting Sand.

Editor American Machinist:

I was making at one time some castings with a very steep joint; I used to get lake sand, wet it and sleek it up. One day a tramp came along and stood looking at me. Said he, why don't you get some rags for that job and use them in the place of that sand.

I got some rags, wet them and put them on, and they beat all the parting sand and paper I ever tried.

THOS. WALTHEY.

Halladay's Machine for Sharpening Circular Saws.

In our issue of April 10 we illustrated a machine for sharpening band saws. Our present illustration represents a machine for sharpening circular saws, either cross-cut or rip, from 6″ to 30″ in diameter.. The description we then gave of the operation of that machine will, in all substantial particulars, apply to this one, especially so far as automatic operation is concerned.

The countershaft is run at a speed of 650 to 700 revolutions, feeding 50 teeth per minute. The tight and loose pulleys on countershaft are 4″ diameter, with face for 2″ belt.

The emery wheel for cross-cut saws is 9″ diameter and 1⅛″ thick, and for rip saws 9″ diameter and ⅜″ thick.

The New York Supply Company, 50 John street, are agents for the sale of these machines.

Irregularity in the Contraction of Duplicate Iron Castings.

By THOMAS D. WEST, CLEVELAND, OHIO.

A PAPER READ BEFORE THE CHICAGO MEETING OF MECHANICAL ENGINEERS.

Many have been at loss to know why foundries are so unsuccessful in producing equality of contraction in duplicate castings. Columns, for example, ranging from 10 to 12 feet long when cast are generally found to vary in length from ⅛ to ½ an inch. A similar variation in contraction often perplexes the designer and engineer in such castings as half fly wheels, pulleys, and in castings for machines where uniformity in contraction is desired and figured for.

The main cause of all this variation in the contraction of duplicate castings is simply that the mixture of iron in them is not exactly the same. The difference in contraction which will be caused by the slightest change in the mixture of iron is often surprising. Why mixtures are not produced exactly alike is a question which many will be interested in having answered.

To obtain exactness in mixtures of iron melted in a cupola calls for conditions over which, even when known, foundrymen can often have little or no control. These conditions are: First, that the iron used shall be of uniform chemical composition. Second, that the fuel with which the iron is melted be also uniform in chemical composition. Third, that the foundry foreman and melter be men possessing good judgment and knowledge of iron and management of cupolas. Fourth, that the character of the work moulded will admit of uniformity in heats and charges of iron.

The difficulties to be encountered in meeting the first condition will be easily realized by those familiar with iron. The greatest element of uncertainty in obtaining like mixtures in the selection of iron is caused by the use of scrap.

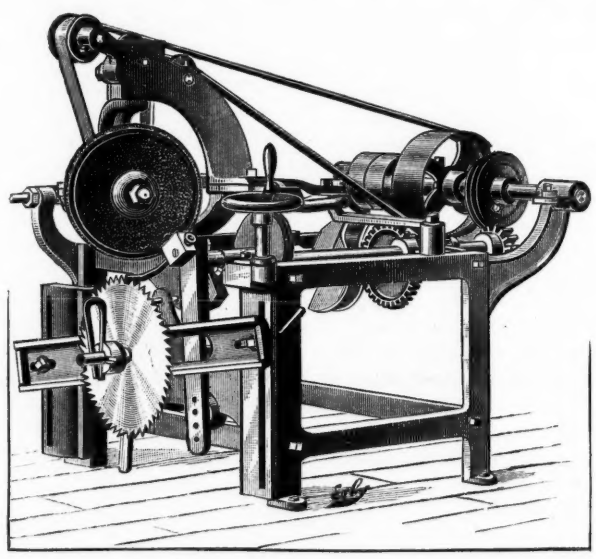
With pig all made at one cast, a uniform mixture can be relied on so far as that material is concerned, but upon scrap such reliance cannot be placed, for the reason that under the most favorable circumstances there can be no certainty of its being all alike in composition. In a large pile of scrap composed of one kind of castings, although the iron may appear even in grade, yet it is certain that there must exist a dissimilarity in its chemical composition, from the fact of the scrap having been collected from castings made from different heats and from different irons. If from a scrap heap all of one kind this difficulty arises, what is to be expected of scrap piles of such variable character as are generally found in foundry yards.

The evil tendency of variable fuel to cause irregularity in the mixtures of iron cannot but be foreseen when the variable percentage in carbon and sulphur is considered which new shipments of fuel are liable to contain. This point may be said to be a delicate one, but nevertheless it requires attention, as sulphur and carbon in fuel are very effective elements for changing the character of iron melted in a cupola. It will of course be evident from the manipulations required for melting cast iron in "air furnaces," where the iron is not tapped out until it all is melted, and where the fuel and iron are separated, that under good management the chances are greatly in favor of greater uniformity in the mixtures of iron, at any rate for one heat, when melted in that class of furnace.

The importance of the third condition will be evident to all from a perusal of the points here treated.

The fourth suggestion presented is practically the one which causes most variations in the contraction of duplicate castings from jobbing foundries, etc., and is one to which the jobbing foundry foreman, even if fully posted, is often forced to submit. In a jobbing or machine foundry two heats can seldom be arranged alike; and again, in one heat there may have to be several different grades of castings made, and therefore of iron melted. Under such a state of affairs could the foreman have all the fuel and iron evenly graded for some special line of castings, it would be seldom that he could arrange his work economically so as to insure uniformity in the contraction in some special line of castings.

There are several plans of melting by which uniformity in the contraction of duplicate machinery castings may be obtained. Some of these are more expensive than the ordinary and every-day practice will admit, and so they are little used or known. Yet,



HALLADAY'S MACHINE FOR SHARPENING CIRCULAR SAWS.

as it may be found necessary to resort to these plans in some cases on account of the variable character of the line of work in a shop, or because some specially fine measurements are to be desired or obtained, it will be well to notice them.

The first plan is simply to make a special heat of the kind of mixture desired, and large enough to give all the iron for the number of castings desired. This iron as it comes down should be collected in a ladle large enough to hold it all, after which it is then poured out into a pig bed. The pigs thus obtained are then free from any other mixture, and are remelted and used for pouring off the moulds or castings desired, which may, on account of the facilities for moulding, require more than one heat. The expense of this plan, and the limit to the amount of iron which can be obtained for it, and also its frequent impracticability, would be forcibly impressed upon any who might desire to get a foundryman to practice it.

The second plan is to collect sufficient pig and scrap all of the same class to make the number of castings desired. Then let the same be charged and melted down in heats entirely free from any other mixture. This plan would resemble the former in cases where the shop cupolas were in constant daily use melting iron foreign to the special mixture desired, or where the melting capacity of the cupola is greatly in excess of the weight necessary for the special mixture, in presenting disadvantages, practically as well as economically.

The third plan is to charge the special graded iron at the first of a heat, and then, after the charges are all melted down, to shut off the blast and renew the bed with fresh fuel and charge on whatever other mixtures are desired till the cupola is full. When this is done the blast is again started, and the balance of the heat is run off in the ordinary manner. The length of time which may elapse between the first and second blow can range from the earliest moment up to three hours or more, but the sooner the second blow is started the better are the chances for procuring hot iron. Again, if the first blow was to exceed one quarter of the melting capacity of the cupola, it may be necessary for the breast to be knocked out and to have the dirt and slag cleaned out. All details necessary to be followed in manipulating this third plan have been given elsewhere by the writer, so that no further reference need here be given.* However, it might be well to state here that this third plan is more economical and often more practical than the first two plans given.

The fourth and last plan which will now be noticed is one which can be practically applied by most all foundries, although it is not nearly so reliable as any of the other three given above. By it, fly-wheels sixteen feet in diameter, weighing over fifteen tons, cast separately in halves, are often made under the supervision of the writer, and when put together no difference is discernible, in their diameter or contraction. Before commencing to cast a batch of wheels, enough iron of the same character is gathered on hand to run off the number of wheels wanted. In justice to foundry men it should be said that one thing which also greatly favors the results obtained is the large quantity of iron which has to be charged. If the quantity was small the same success could not be expected. It is to be understood that other mixtures are run through the cupola at the same heat, and to prevent their getting mixed with the fly-wheel iron more of the fly-wheel iron is charged than is wanted, and to use it up some piece is made to follow the fly-wheel pouring, for which nothing definite in mixture is required.

It will of course appear from the remarks upon fuel in the previous part of this paper, that in all of the above four plans care must also be taken to see that the character of the fuel is as uniform as possible as well as that of the iron.

Another point which has a bearing upon the question here at issue is the temperature of the metal when poured. This affects it by reason of the difference which exists in the contraction of hot and dull-poured metal; also by the power of liquid iron to strain a mould or to fuse its surface sand, by which a scale may be formed upon the surface of the casting, in massive work from $\frac{1}{32}$ to $\frac{1}{4}$ of an inch deep. The hotter the metal is when poured, the more it can increase strainage, and fuse the surface of the mould and affect the finished size. With reference to the difference in contraction of hot and dull-poured metal as far as its own elements are concerned, several trials which have lately been made, using bars 5 feet long by 1½ inches square, cast horizontal and carefully moulded by the writer, have showed that hot-poured metal will contract more than dull-poured, as the hot-poured bars contracted on an average about $\frac{1}{32}$″ more than the dull-poured bars. The bars were poured by means of a ladle holding about 100 pounds of metal. The metal in the ladle, after pouring one bar, was allowed to cool down naturally until it was as dull as could be safely used for giving a good full-run bar. The gates for both bars, it might be well to say, were cut large, so that the moulds could be quickly filled. From these three facts, it will appear evident to all that duplicate castings should be poured with metal of like temperature.

This whole paper is of course based upon the supposition that the setting of sweeps, mouldings, and rapping of patterns, etc., are always performed alike by the moulder; but it is not intended that any should turn upon the author with the question—Do they?

* American Foundry Practice.

A Case of "Girl-cotting."

The latest instance of boy-cotting that has come to our notice is a case of girl-cotting. In order to influence the settlement of a labor dispute in a single factory, a number of large establishments in Troy, N. Y., manufacturing collars, cuffs and shirts, have united in a general lock-out, throwing out of employment thousands of operatives, mostly girls, and carrying loss and distress into thousands of homes. This sort of thing is not justifiable or creditable to the establishments engaged in it.

Employers cannot consistently expect to have the law and public sentiment arrayed on their side, when they are subjected to a "boycott" in order to bring a pressure upon other employers, if they show such readiness to adopt the same tactics at wholesale, in order to influence the adjustment of a labor dispute in a single establishment.

Clearly what is needed in manufacturing circles just now, is a liberal application of the principle embodied in the Golden Rule.

The American Water Works Association will hold its sixth annual meeting at Denver, Col., June 23d, 24th, and 25th. The secretary is J. H. Decker, Hannibal, Mo.

Our occasional contributor, William Henry Harrison, of Braintree, Mass., has caught the infection now spreading among war veterans and writes the story of the sinking of the Albemarle in October, 1864, for a local paper. Mr. Harrison was chief engineer of the Shamrock, and is an adept at telling stories.

We are informed that the Wallis Iron Works, of Jersey City, have the stairways and elevated footwalk for the approaches to the bridge of the Suburban Rapid Transit Company across the Harlem river near Second avenue, in this city, nearly ready for erection. These stairways and the footwalk across the bridge, the construction of which was imposed upon the company by the Department of Public Parks as a condition of granting permission to build the bridge at that point, will not be of any use to the public until the Department causes Lincoln avenue, on the north side of the river to be graded. Stations are being erected at One Hundred and Thirty-third, One Hundred and Thirty-eighth, and One Hundred and Forty-third streets. Trains are already running. The locomotives are furnished by the Baldwin Locomotive Works, and the car by the Pullman and Gilbert companies.

The Franklin Institute, at their Novelties Exhibition, promised to award "a grand medal of honor to the invention or discovery shown at the exhibition which shall be held to contribute most largely to the welfare of mankind." After considerable delay, the Board of Examiners have recommended that the medal be awarded to T. S. C. Lowe, of Norristown, Pa., "for his substantial improvements in the manufacture of water-gas, and for his numerous improvements in methods and appliances for the utilization of water-gas as a fuel for domestic and industrial purposes, and as an illuminating agent."

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NEW YORK, JUNE 5, 1886.

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The Steam-Engine Trade.

Considering the activity in the steam-engine trade of the past ten years, it seems strange, at first thought, that the business keeps up so well as it does. It has certainly seemed at any time during the period named that the steam-engine business would present a genuine case of over-production, about which so much is said and so little seen.

It is, perhaps, a fact that there are too many builders of steam engines, at least too many to insure good prices, but the number of engines sold yearly is almost enormous, and apparently much beyond the legitimate needs of business requirements for steam power, including the decrease of what may be called wearing out.

There are reasons why this is so, and they have an important bearing on the steam-engine trade. One is that the average life of a steam engine is much shorter than ever before. It is more heavily loaded, and run faster than formerly. It is also more generally recognized that the steam engine is a machine that ought, in the interest of good economy, to be considered worn out after reasonable service.

Another reason is that the value of a good steam engine is better understood now than it used to be. There is not much ceremony now-a-days in setting aside an unsatisfactory steam engine, and putting a better one in its place. This is done every day in the instance of engines that have not been more than a year or two in service. It has come about from a better understanding of the importance of the motive plant, growing sometimes out of the absolute necessity of manufacturing cheaply, from applying hard figures to the gain or loss from reliable or unreliable power.

Selling these discarded engines is not so easy a task as it was. There is greater accumulation of them under sheds and in storehouses. A good many of them find their way into the scrap heap, to the mutual advantage of the user and the builder of steam engines.

In engines for large power there is a very evident movement in favor of compounding; this may be depended upon to help in increasing the steam-engine trade, as many compound engines will replace others that will not find their way into use again. There is much thought being given to compounding, and it is the almost universal opinion that its advantages have been largely under-estimated. The reason for the failure of the compound engine to show the gains it is capable of when used in factories is coming to be better understood, and to be justly attributed to faults in design and operating rather than in principle. Many engine builders who have, on general principles, condemned compounding, have apparently changed their minds within a year or two. From this awakened interest there is good reason to believe that we shall soon get additional light on this important subject.

On the whole, there is no branch of the machine business in which the future prospects look better than in the steam-engine trade. There are so many things about a steam engine that make it either economical or the reverse, and these are becoming so generally known, that so long as progress is made trade will be assured. In no country in the world is the importance of progress in steam engineering better understood than in this country.

There is another incidental feature that has an important bearing on this subject. That is, the fact that the stationary engineer is becoming better educated in his duties. And two of the important duties of the stationary engineer are to furnish reliable and regular motion, and to do this on small coal consumption. With his increased knowledge the stationary engineer is becoming an important factor in bringing about changes in motive power. No one is likely to obtain knowledge without finding opportunities to use it.

The American Institute of Mining Engineers had a large meeting last week at Bethlehem, Pa. When this issue reaches our readers the American Society of Mechanical Engineers will be at their spring meeting in Chicago. The Master Car Builders Association will meet at Niagara Falls the second week in June, and the American Railway Master Mechanics Association will meet at Boston the next week, June 12th. The summer meeting of the American Society of Civil Engineers will be held at Denver, July 1 and 2. The reports, papers and discussions at these meetings will form important additions to mechanical and engineering literature.

Where a Union is Wanted.

In our department of "Manufactures" this week we publish items from a number of machine shops in this city showing the effect of labor demands. The situation is a checkered one. It was understood that machinists in this city, who are in the Central Labor Union, would not ask for anything more than nine hours a day with the same wages as heretofore paid for ten hours. But in some shops the workmen have made a whole catalogue of demands. As soon as one demand was conceded another was thrust to the front. Concessions have been governed very much by the pressure of orders on hand. New York city is an expensive place, both for shop owners and workmen. Much of the machine work done here could as well be done in cheaper localities, and if the cost of work is much increased it will inevitably be done elsewhere. The shipbuilding industry, which was quite extensive in this city a few years ago was driven out entirely—never to return—by the advanced cost of labor and space on the water front. We do not propose to moralize a single line over the folly of the workmen in demanding too much, for it would be useless. Men who have nothing but their labor to sell are just as likely to ask excessive and unreasonable prices as men who have merchandise to sell, and no more so. Both may seek an opportunity. The workmen in New York have an organization—imperfect though it may be—and the shop owners have none. When the latter lay aside all local jealousies and form a strong union, as shop owners have done in Chicago, they will be in position to settle all labor questions before strikes occur, and in such a way as to retain machine work in New York instead of allowing it to be driven out.

Laxity in Enforcing Laws.

Since the recent riots by imported anarchists there have been loud calls through the daily press for the more rigid enforcement of laws. This is well, and we hope to see the movement extended rather than limited to criminal laws. How this spasm of indignation growing out of the non-enforcement of laws by those whose duty it is to compel observance is regarded by the workingmen (not Anarchists and rioters) is shown by the following paragraph, which we find in the *National Labor Tribune:*

While there is general demand for strict compliance with law upon the part of striking workmen, there has been very little in the way of wholesome example shown them by those who should know better, and whose interest would seem to be in the observance of all legal enactments. Strange, too, that while this general demand is aimed more especially at men who seek to secure eight hours as the day of labor, the federal authorities neglect or refuse to enforce section 3,738 of the revised statutes, which provides that eight hours shall be the day of labor of workmen in the employ of the federal government. It will be noted also that though Congress passed the act referred to, and is in the midst of a session in which much time has been given to the labor troubles, yet no member has arisen and demanded the enforcement of this law. Practice can be asked for with ill grace where example is so palpably lacking.

Most of the recent riots and depredations by so-called workingmen have been committed by gangs of swinish foreigners, imported in lots by hoggish corporations and agents of contractors to take the place of American workmen at lower wages. Some time ago Congress enacted a law prohibiting the importation of workmen under contract with prepaid passage. It was a greatly needed law, but it is not enforced. Officers who are sworn to execute the laws allow this one to be violated without an effort towards its enforcement. A short time after the law was enacted the members of a firm in this city were proceeded against by the U. S. authorities for importing a lot of weavers in plain violation of the law. It was evident that they had defied the law, but through a legal technicality they escaped the penalty. The next morning's issue of the New York *Times* contained an editorial congratulating the firm upon successfully evading the law. The same paper is now crying for Gatling guns to shoot down the dynamiters and bomb throwers whose importation it has steadily encouraged. It is plain that we need a stronger public sentiment to compel the execution of all the laws. This is the only way to make any law respected.

The enforcement of a bad law will lead to its repeal. Where large monied interests are opposed to certain laws they are frequently evaded in an open, shameless manner. Anarchists who believe in no laws at all are not likely to be converted into law-respecting and peaceable citizens by observing these cunning infractions. If that class of people continue to be imported (very few would be here if they had to pay their own passage) danger is ahead. It can only be averted by a reform in the administration of the laws.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(227) J. H., Marseilles, ——, writes: I have had my cistern cemented and the water tastes of lye. I have pumped it out once, but it is nearly the same. Will you please tell me through your paper will this taste leave it, or must I pump it out again and let it dry for a time? We have to use it for cooking. *A.*—The cement, if good, should not impart a bad taste to the water, and if the taste does not soon disappear it would be well to have the water analyzed to discover the cause of the bad taste. Perhaps lime was used with cement, which would give an alkaline taste, but should soon disappear. Lime should not have been used, as pure cement and sand would have been better; but if the trouble is caused by lime it will not be hurtful to the user.

(228) J. K., Brattleboro, Vt., will find description of case-hardening furnace, also process of case-hardening, in the AMERICAN MACHINIST of February 25 and April 22, 1882. Size can be modified to suit.

(229) E. S., Auburn, N. Y., asks: What is pattern-maker's varnish made of, and how applied so that it will not peel off? *A.*—Pattern-maker's varnish is made by dissolving shellac in alcohol until of the proper consistency. There is no danger of its peeling off if applied in light coats. After applying the first coat sand-paper over with fine sand-paper.

(230) F. S., Columbus, Ind., asks: Which of two pieces of shafting will stand the most strain, the diameter being the same, one that is solid, or one that has a hole through its center? *A.*—The one that is solid. For the same amount of metal the hollow shaft, properly proportioned as to diameter, will be the strongest, and this seems frequently to lead to the fallacy that a shaft will be stronger for removing part of the metal composing it.

(231) J. C. H., Savannah, Ga., writes: We have a boiler 48" diameter, 28' long, with two flues 16" diameter; grate, 4x6 feet. Our fuel is shavings and refuse usually found around a planing mill. 1. Will this boiler supply an engine with cylinder 8"x16", plain slide valve, running 175 revolutions per minute? *A.*—The boiler should be ample for the engine. 2. We are located on high ground, with no obstruction. Will a stack 16" diameter, 30' high, give sufficient draft? *A.*—We should make the stack not less than 20" diameter and 50' high. It would be still better if 24" diameter.

(232) G. M. C., Rochester, N. Y., asks for a method of "washing oil" after it has become dirty and thick by use in cutting screw threads, and has to be thrown away. *A.*—We do not know of any method of clarifying oil which does not cost as much, or more, than new oil. The Brown & Sharpe Mfg. Co. write us that they use the best lard oil on their gear cutters. They strain the oil, separate it from chips and dirt with a centrifugal separator and add new oil to the old, as it is required.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

"Morrison's Practical Engineer." A complete treatise (200 pp.) on steam and general mach. Mailed on receipt of $1. W. A. Morrison, Box 373, Lowell, Mass

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Curtis Pressure Regulators, Curtis Return Trap Curtis Damper Regulator. See May 1, p. 10. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Bound Volumes of the AMERICAN MACHINIST for the years 1880, 1881, 1882, 1883, 1884 and 1885. These volumes are strongly bound in cloth, and will wear well. Price $3.50 each; express charges additional. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

The Equitable Gas Light Co., of New York, are to erect a $46,000 brick factory on Forty-second street.

John S. Raggio will erect a three-story factory, 40x85 feet, at Fifth and Wilde streets, Philadelphia.

Thomas Ward will move his foundry and plow factory from Harper's to Fayetteville, N. C.

P. Echert & Co., Cincinnati, will erect a brick candy factory, 130x68 feet.

The Middletown Paper Co., of Cincinnati, will erect a two-story brick mill, 75x120 feet.

The Mosler Safe and Lock Co. are erecting a four-story brick factory in Cincinnati.

The Sioux City and Pacific Railroad will erect new machine shops at Missouri Valley, Iowa.

The B. & O. R. R. will erect workshops and a round-house at Harrisonburg, Va.

Phillip H. Jackson, Newark, N. J., will erect a two-story brick foundry on Mechanic street.

Church & Jackson, of Sterling, Mich., will build a new foundry.

John Post, of Midland Park, N. J., will erect a new 200x50 ft. silk mill at that place.

W. B. Jones, of Manchester, Iowa, will build a new woolen mill at Rock Valley.

The Pennsylvania Railway will build a machine shop at Germantown, Pa.

The Disston Saw Works are about building another shop on Delaware avenue, at Tacony, Pa.

Wilson Kistler, Chas. Kreamer and S. D. Ball, of Lock Haven, Pa., will erect a new nail mill.

D. H. Thomas and A. D. Thomas will manufacture cotton presses at Morrillton, Ark.

An iron foundry has been started at Conway, Ark.

John Gubbins will erect a three-story factory, 100x45 ft., at 349 S. Canal street, Chicago.

Los Angeles, Cal., is to have water-works, owned by a private company.

The Knights of Labor of Spring City, Pa., will build a new foundry.

Thomas Howard, of St. Louis, Mo., will erect pipe works and foundry at Chattanooga, Tenn.

B. Hamill & Co., of Cumberland and Mill streets, Germantown, Pa., are erecting a 2½ story 30x56 ft. addition to their woolen mill.

Thomas A. Watson, of East Braintree, Mass., will build a new machine shop near Weymouth Tollbridge.

An effort is being made at Chattanooga, Tenn., to organize a stock company with a capital stock of $200,000, to erect a cotton mill of 10,000 spindles.

The U. S. Bunting Company, Lowell, Mass., will soon build a large mill in the yard of the Wamesit Power Company.

A. J. Brown and Mr. Snyder will organize a company to build a $15,000 roller flour mill at Alvarado, Texas. $10,000 has been subscribed.

A new nail mill will be erected at New Waterford, Ohio. Capital, $50,000. D. D. Chichester and others are interested.

A permit has been granted to the Wood Mfg. Co., of Camden, N. J., to erect a worsted factory, 53x150, at Fifth and Erie streets.

Steps are being taken to secure the location of a foundry and machine shop in Washburn, Wis. Address T. L. Sullivan, President of Board of Trade.

The Prospect Machine and Engine Co. is the name of the corporation formerly known as the Cummer Engine Co., Cleveland, Ohio.

Jennie S. Macdonald, 1532 Park avenue, New York, will erect a five-story brick factory, 40x60 ft., on Seventieth street, to cost $20,000.

Burnet & Co., founders, 706 East Twelfth street, New York, are paying an increase of ten per cent.; also giving ten hours' pay for nine hours' work.

H. Margerison & Son, 227 E. Chelten avenue, Germantown, Pa., will erect a new towel and table cloth factory at Millville, N. J.

McCurdy & Warden, 276 West street, New York, are building a marine boiler 15 feet long, by 90 in. front. They employ thirty men ten hours per day.

E. Broad & Sons, St. Stephen, Me., are increasing the capacity of their axe factory, the extension to be 30x80 feet in size.

J. P. Witherow, of Pittsburgh, Pa., has the contract to build the furnaces for the De Bardeleben Coal and Iron Co., at Birmingham, Ala.

Subscriptions are being received at West Point, Miss., toward the erection of a cotton factory. The building of a foundry at the same place is contemplated.

Suizer & Vogt, proprietors of the Louisville Machine and Elevator Works, Louisville, have recently added to their works boiler and sheet-iron shops.

The Chicago Steel Manufacturing Company have already started to build their new foundry at Hammont; the brick and stone for the new building is on the ground and much of the foundation is in.

The Duplex Steam Heater Co., 10 Barclay street, New York, have issued a finely printed pamphlet of their automatic steam heater. It is finely illustrated.

A new woolen mill will be established in Charlestown, Ind., by a stock company, with a capital of $25,000. Capt. I. N. Raymaker and others are interested.

J. E. Warren & Co., have the contract for building an addition 14x70 to the Marlboro (Mass.) foundry building. Quite a building is being erected for the foundry for storing and making patterns.

The Baldwin Locomotive Works, Philadelphia, are to build sixty standard-gauge locomotives for the St. Louis, Arkansas and Texas (late Texas and St. Louis) road.

Z. P. Dederick has purchased the Sherman Iron Works at Sherman, Texas, for $10,000, and will spend about $15,000 in enlarging the building, repairing the old machinery and the purchase of new.—*Baltimore Manufacturers' Record.*

The Lebanon Mfg. Co., Lebanon, Pa., are about enlarging their works. The old foundry will be converted into a machine shop. A new foundry, 203x60 feet, will be erected, containing all modern improvements.

E. C. Atkins & Co., Indianapolis, are preparing to erect a three-story brick block, corner Eddy and South street, in which to manufacture band saws for log mills. The building will cost $15,000, and will be finished by September.

A. L. Ide & Son, Springfield, Ill., builders of the Ide Engine, have published a pamphlet containing quite a number of fac simile letters from establishments using their engine. All commend the engine in the fullest terms.

The Gorton Boiler Mfg. Co.,, 110 Center street, New York, have issued an illustrated pamphlet of their house-heating steam generator. It is automatic, base-burning, self-feeding, tubular; is made of wrought iron, and has center feed.

John Roach & Son, Morgan Iron Works, Ninth street, New York, are employing but few men on repairs and in finishing the U. S. S. Atlanta. The men work ten hours, and have made no demonstration for increase of wages or decrease of time.

A movement is on foot to reorganize the Worcester (Mass.) Mitis Company, which owns the franchise for the State of Massachusetts, and to purchase the present foundry of the Worcester Malleable Iron Company, and largely increase the plant.

F. J. Obert, Jr, and Hunter S. Eckert have taken possession of the Union Boiler Works, at Reading, Pa., and are arranging to make numerous improvements, so that the establishment will be one of the most complete in the country.—*Industrial World.*

The Cameron Steam Pump Works, East Twenty-third street, New York, are employing one hundred men ten hours a day, and are fairly full of orders. An increase of ten per cent. in wages has been given the men, who have not, and are not expected to strike.

W. H. Jackson & Co., East Twenty-eighth street, New York, employ 600 men. The machine shop runs nine hours per day, and the foundry ten hours. A ten per cent. increase in wages has been made, and the men reported as satisfied with the arrangement.

San Bernandino, Cal., is to be the site of the car shops, round-houses, etc., of the California Southern Road. The works will occupy 18 acres. Property has risen one-third in value since the announcement. A $75,000 hotel is to be built, and a great impetus has been given to business.

At the annual meeting of the stockholders of the Nashua Co-operative Foundry, Nashua, N. H., they voted to take six per cent. per annum, and that the balance of whatever may be earned be divided among the workmen, whether stockholders or otherwise.

The *Sanitary News* says: "The Columbus, Ohio, Board of Trade has indorsed the enactment of a law to permit the water-works trustees to contract for a new pumping engine without having the money in the treasury, the pump to be paid for by the earnings of the works."

Peck, Howard & Co., Washington Iron Works, 74 West street, New York, are working 20 men 10 hours per day on repair work. They report no dissatisfaction among their men, and also state that many men are applying to them for work who are out on strike at other shops.

The St. Louis Pipe Co., of St. Louis, Dennis Long & Co., of Louisville, Ky., and the Cincinnati and Newport Iron and Pipe Co. have combined and bought a tract of 15 acres in Chattanooga, for the erection of a large cast iron pipe works. Will employ 600 to 1,000 hands. Work is to be begun on buildings this summer.

It is said that parties in Foxcroft, Me., contemplate erecting an iron foundry. The foundry of the Messrs. Mayo, near the mill, has shut down indefinitely, but the machine shop there will run as usual, and is to receive additional tools and machinery. This shop will be used by the proprietors of the new foundry.

Slater & Reid, 409 West street, New York, are thoroughly overhauling the steamer Dupui de Lorne, and are putting in a new shaft, hub plates, sleeve and bushing. They employ eighty men, sixty outside and twenty inside shop. They are working nine hours per day, and eight hours on Saturday.

The Rand Drill Co., 23 Park Place, New York, have issued a new illustrated catalogue of their Little Giant, Slugger and Economizer Rock Drills and improved Air Compressors. The catalogue is well printed, the machinery is well described, and a lot of fac simile letters from parties using their machinery are shown.

Gilbert & Walrath, Little Falls, N. Y., are making extensive changes in their starch and paper mills by changing it to a large knitting mill. They have built an iron bridge across the Mohawk river, and have just completed a boiler chimney, which was built from a design illustrated in the AMERICAN MACHINIST of March 27, 1886, by Wm. Lowe.

Henry W. Bulkley & Co., 149 Broadway, New York, have issued a tasteful new pamphlet catalogue showing various forms of the Bulkley injector condenser, as built by them. It includes views of the condenser as connected with a horizontal engine, as siphoning from a natural head of water, as attached to vertical engines, and as operated by an independent air pump.

The Waterhouse Electric & Mfg. Co., Hartford Conn., is a new competitor for public favor in the business of arc electric lighting. Among the directors we find the names of several prominent mechanics, including Francis A. Pratt, of the Pratt & Whitney Co., and Charles E. Billings, of the Billings & Spencer Co. The system employed is described in a neat illustrated pamphlet.

John A. Carnie, 223 West street, New York, is building a compound engine for the New Jersey Lighterage Co. The cylinders are 15" and 30" in diameter, by 22" stroke. They are also building a beam engine to go into stock. Twenty men are employed in the works. They work ten hours per day, and the time and pay are reported as satisfactory to both employer and employe.

Holland & Thompson, of Troy, N. Y., have concluded arrangements for the removal of their plant to St. Paul, Minn. They are extensive brass founders, and manufacturers of brass fittings of every kind, lead pipe and steam heating apparatus. They also manufacture an improved sectional boiler used in steam heating. They will organize at St. Paul as the Holland & Thompson Mfg. Co., retaining a warehouse at Troy.

The Quintard Iron Works, Wm. H. Wallace & Co., East Eleventh street, New York, are building two 20-ton boilers for the steamer City of Monticello, new gas tanks for the Consolidated Gas Works, and a compound engine, 14" and 20" cylinder by 24" stroke, for the steam yacht Fidelma. One hundred and five men are working nine hours a day for ten hours' pay, together with an advance of ten per cent.

W. & A. Fletcher, 266 West street, New York, are building two engines, each 46" cylinder, 10 feet stroke, for the Hoboken ferry boats, and are also building a compound engine for Old Colony Railroad freight boat. The cylinders are 44" and 68" in diameter, by 8 and 12 feet stroke. About 180 men are employed ten hours per day upon an advance of ten per cent., which was given six months ago, without being requested by the men.

E. E. Garvin & Co., 141 Center street, New York, closed their shops when a demand was made for eight hours' work with ten hours' pay. They state that by chance their contracts allowed them to do so, which is an unusual occurrence in their business. The men were told that they might go back to work when they got ready, and the shop has since started up ten hours a day without change in wages.

R. Dudgeon & Co., 24 Columbia street, New York, are employing 50 men 9 hours per day. They pay good prices for labor, and have called 9 hours a day's work for the past ten years. When this firm commenced business they made 9½ hours a day's work, but reduced the time during the labor agitation at the date named. During the dull times, all the men were retained on three-quarter time, although business did not warrant so doing. There has been no change asked during the agitation.

The new Maine Central shops in Waterville will consist of two sets—locomotive and car repair. The main building will be 300 feet long, 100 feet wide; another building will be 300x50 feet, and two others 301x75 and 250x75, respectively. They will require about 2,000,000 bricks in their construction, and 300 yards of foundation stone. The whole will cost about $200,000. A crew of about 300 men will be employed. Work on the new buildings will begin as soon as possible.—*Boston Commercial Bulletin.*

H. Theall, 65 Bethune street, New York, is building two 65-ton boilers for steamer City of Boston, and making a new shaft for the Elm City; overhauling the Continental's engine and boilers; repairing steamer E. N. Bail; making a pair of wheels for steamer Mistletoe; repairing boilers of steamer City of Waterbury, engines of steamers Thomas P. Way and City of Richmond, and police boat Patrol; also Midland ferryboat. This firm employs 300 men ten hours per day, with ten per cent. increase of pay.

Warner & Swasey, of Cleveland, Ohio, have recently shipped to Lick Observatory, California, a 6" equatorial telescope, provided with all their latest improvements; also one of their chronographs. They have received an order for an equatorial of 11" aperture, and a steel dome of 21' diameter, from Smith's College, Northampton, Mass. It will be shipped sometime next month. They have recently shipped a 20' steel dome to Swarthmore College, near Philadelphia, and are at work on a 6" telescope for the same college, to be finished in June.—*Iron Trade Review.*

At the Delamater Iron Works, New York, the workmen demanded ten per cent. advance, which was conceded, whereupon they demanded and struck for nine hours per day, with ten hours pay, which was also conceded. The pattern-makers, at time of going to press, are out on strike for eight hours per day. The foundry is running ten hours. The whistle is blown at five P. M., also at six o'clock for the nine and ten hour men, respectively, to quit work. Overtime does not commence until six P. M., and the nine hour men who work overtime must loaf one hour before commencing to work overtime. Mr. Delamater states that as fast as present contracts are filled the men are laid off indefinitely, and that under the present condition of affairs he can see no other course than to close down the works entirely when all existing contracts are filled.

A few months since R. Hoe & Co., Grand street, New York, advanced the wages of their 700 employes. The advance ranged from five to fifteen per cent, according to the wages paid. A request was made by the employes for nine hours with ten hours' pay. One of the firm states that nine hours would not pay either him or his workmen, but he told them he would try nine hours as an experiment if they would give up the recent advance, and upon that basis the works are now running. Already he says that the increased cost of production has caused new contracts to be withheld, and he is forced to discharge his men as fast as existing contracts are filled. No stock work will be done until the matter is adjusted, as under the present state of affairs the firm feels sure it is only a question of time as to when the entire works must be closed.

A. & F. Brown, 42 Park Place, New York, manufacturers of pulleys and shafting, were requested by their men to increase wages fifteen per cent. for all employes receiving less than $15 per week; ten per cent. for employes receiving over $15 and less than $18 per week, and five per cent advance for all receiving $18 or over per week. The advance was granted, and in a few days the firm was requested to sign an agreement to employ none but union men. This request was also granted, whereupon the workmen demanded a reduction of the number of hours from sixty to fifty-three per week. This demand was also acceded to. During the month which has elapsed since the above the number of orders received has fallen off 100 in number from what would have been due under the old rates. Mr. Brown says that orders during the present month will fall off fifty per cent., owing to the increased cost of production in this city, while in other places orders are and can be filled at the old rates.

The Bethlehem Iron Co., Bethlehem, Pa., are said to be preparing to enlarge their plant so as to make armor plate and steel guns, at an expense of $3,000,000. It is certain the Government will want guns and armor plate of improved manufacture in the near future.

Machinists' Supplies and Iron.

NEW YORK, May 20, 1886.

The market is feverish and unsettled, but still dull and without noticeable change.

Iron—There is no falling off in consumption, yet business continues light. The recent advance in coke is claimed to have added 40 to 50 cents per ton to the cost of pig iron, but it is yet dull. We quote Standard Lehigh and North River brands, $18 to $18.50 for No. 1 X Foundry; $17 to 17.50 for No. 2; and $16 to $16.50 for Grey Forge.

Scotch Pig—The demand is slight, and arrivals are stored. We quote Coltness, $20; Glengarnock $19; Gartsherrie, $19.50; Summerlee, $19.50; Eglinton $17.75 to $18; Langloan, $19.50, and Dalmellington, $18.50.

Copper—The market has ruled dull and flat. Consumers are not yet inclined to replenish their stocks. Lake, 11¼c.; other brands, 10c. to 10½c.

Antimony—Demand moderate. Hallett's, 8½c.; Cookson's, 8.80c. to 8.85c.

Lead—Spot lots at 4.70c.

Tin—Banca, 22½c.; Straits and Mallacca, 21.35c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Correspondence wanted with parties wanting good engineer. Address Engineer 451 W. 22d st., N. Y.

Salesman in iron and wood-working machinery; experienced, competent and reliable. Address K., AM. MACHINIST.

Wanted—Position as foundry foreman; 12 years' experience as moulder and five years' as foreman; good reference. "Crossing," AM. MACHINIST.

Draftsman, competent and reliable; experienced in shop and office, with good technical education, desires situation. Address Box 11, AM. MACHINIST.

Draftsman, 5 yrs. exp. locomotives, mach., tools, hoisting machinery, desires engagement. Address Wilbur, AM. MACHINIST.

Wanted—Competent and experienced draftsman on hoisting and mining machinery; state age and extent of experience; also salary expected. Address Box 164, Cleveland, Ohio.

A member of a well-known firm of English engineers is about returning to London; having had great experience in introducing American inventions in Europe, he is willing to make arrangements with a few good firms for the sale of their European patents. Address Anglo-American, care AMERICAN MACHINIST, 96 Fulton street, New York.

Wanted—By a practical iron and brass foundryman an opportunity to engage as partner in the foundry business, or in machine and foundry business; have been 18 years manager, and can give and will expect the best of references; can furnish some capital. Address Iron Foundry, Box 12, AM. MACHINIST.

Wanted—A practical man as foreman of machine shop; one with strictly temperate habits, industrious, accustomed to handling men, and experienced on automatic and plain engines, blast furnace, architectural and iron house work, locomotive and general repairs; none other need apply. Address, stating experience, reference and salary expected, "Manufacturer," AM. MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Engineering specialties; send for price-list. Crescent Mfg. Co., Cleveland, Ohio.

Send for estimates of high-speed compound engines for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

Useful information steam users and engineers 100 page book on care, etc., of boilers. Send 25 cents in stamps. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

M. Martin, manufacturer, P. O. Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

FOR SALE AT A BARGAIN.

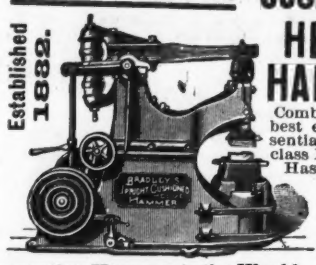
A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock, situated in Leadville, Col. The business will be carried on until sold, thus at once giving a profitable trade to the purchaser. Address,

A. FALKENAU,
Care of Dickson Mfg. Co.,
Scranton, Pa.

Only reason for selling, ill health.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1882.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

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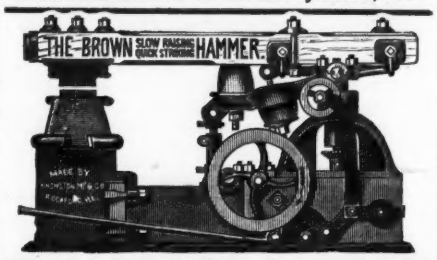

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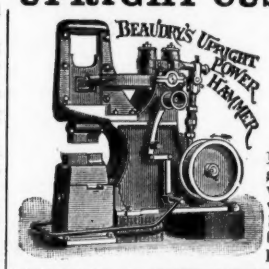

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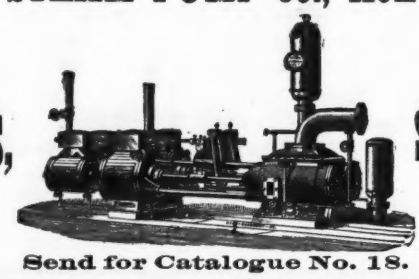

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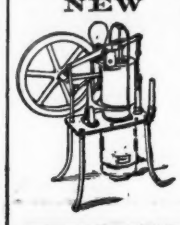

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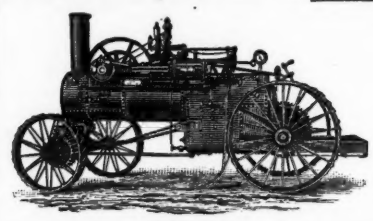

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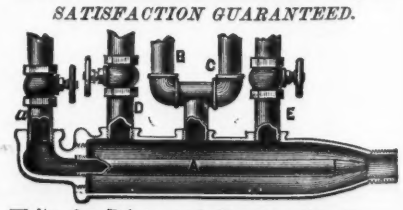

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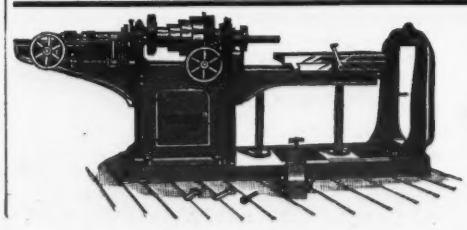

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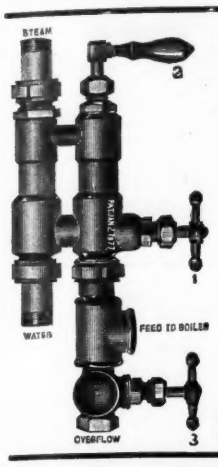

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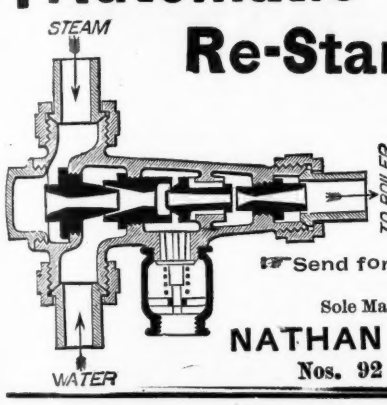

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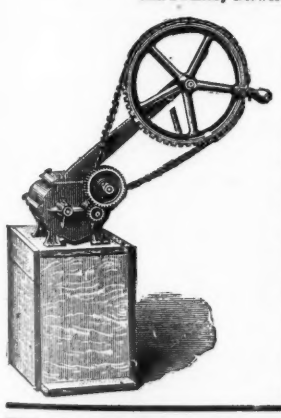

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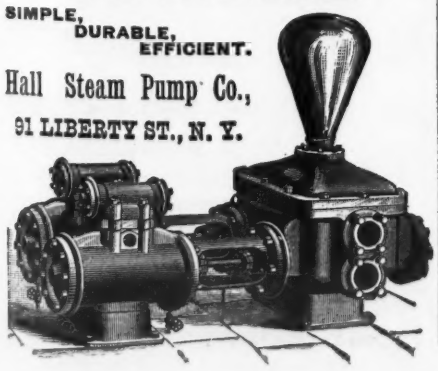

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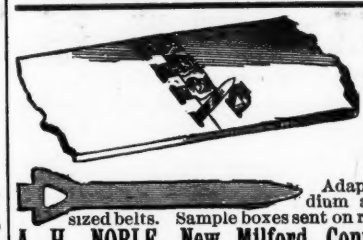

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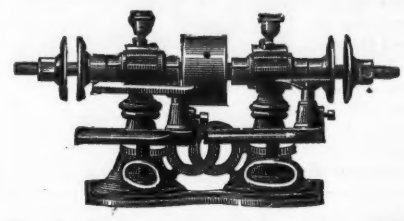

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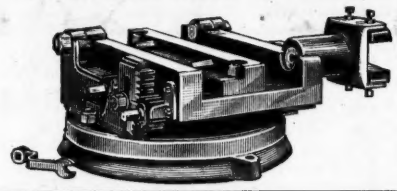

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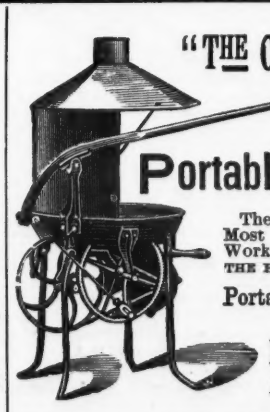

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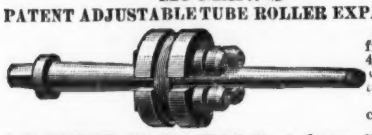

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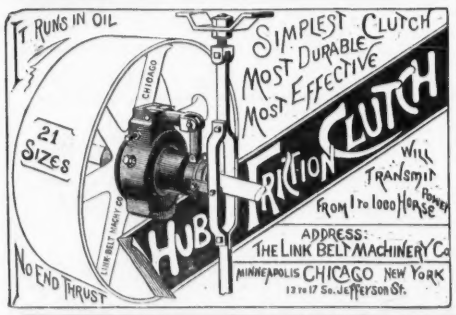

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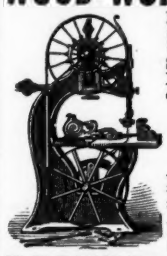

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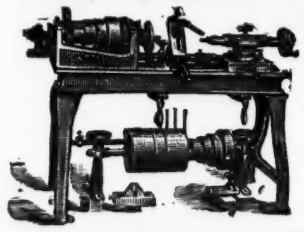

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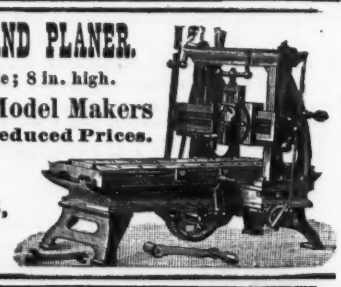

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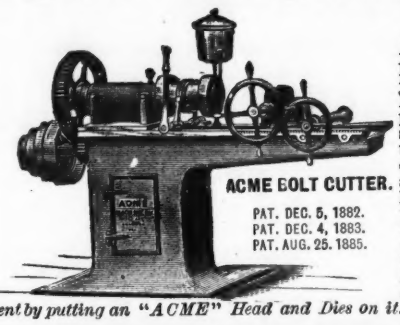

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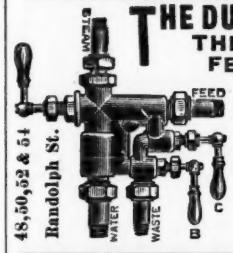

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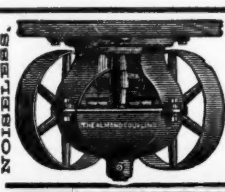

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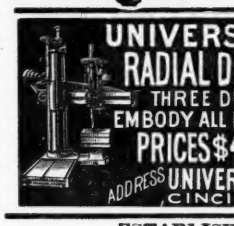

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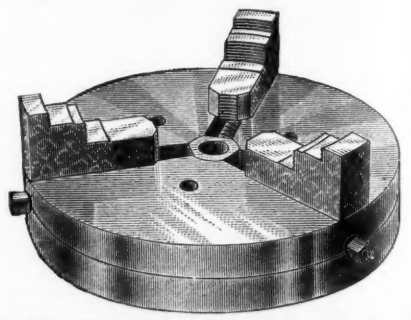

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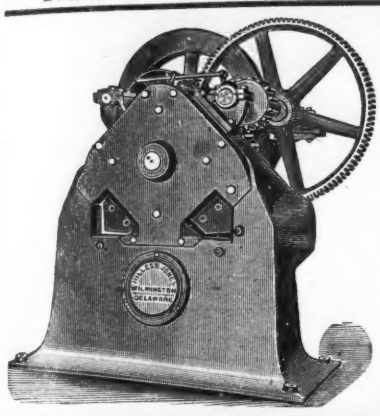

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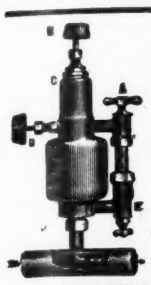

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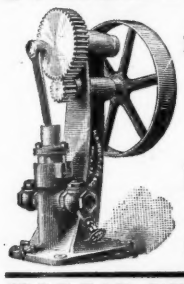

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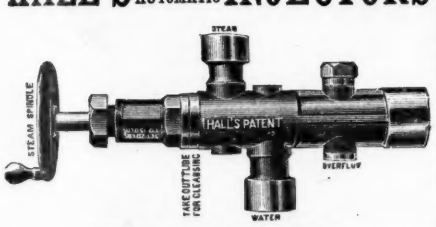

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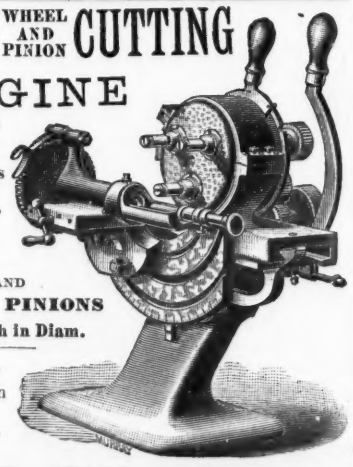

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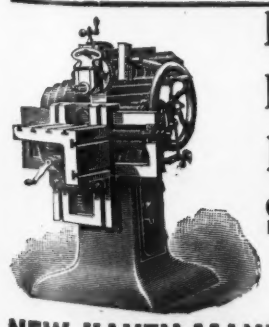

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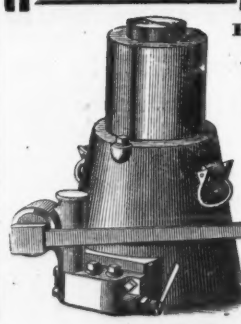

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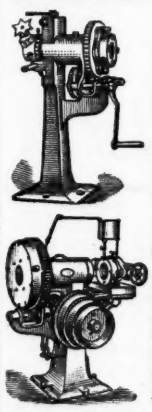

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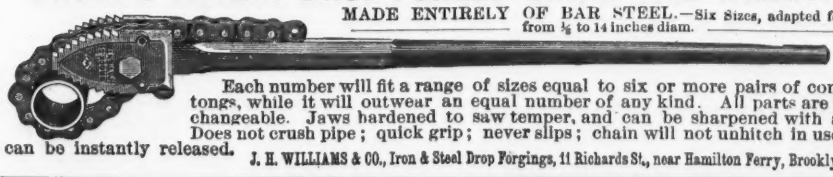

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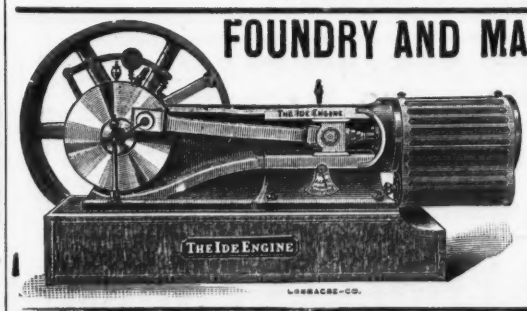

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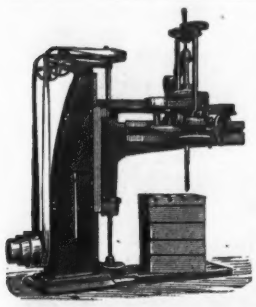

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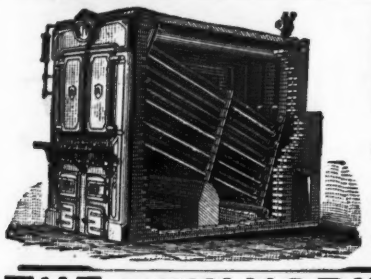

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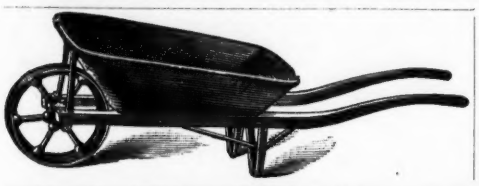

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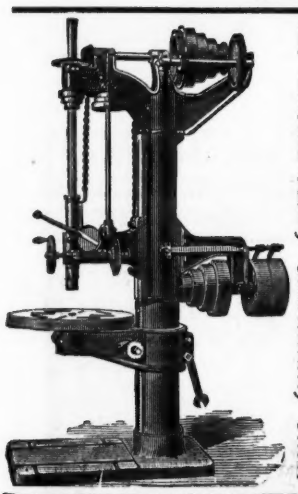

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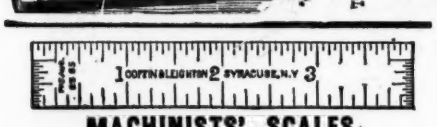

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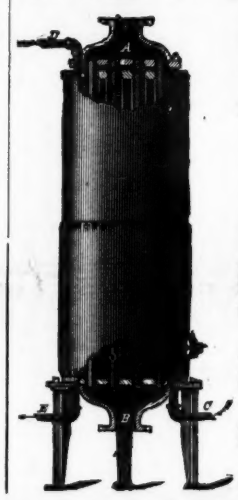

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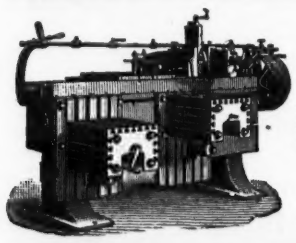

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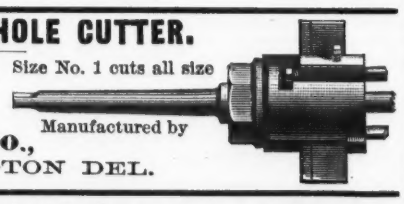

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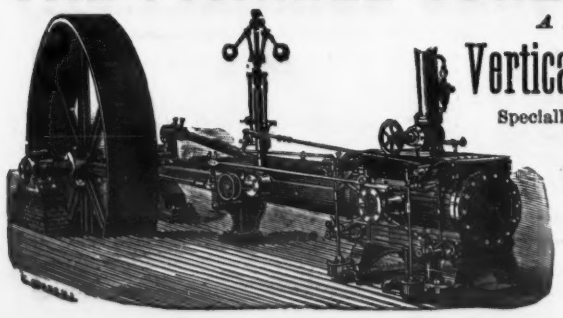

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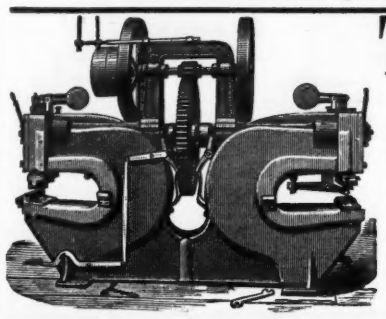

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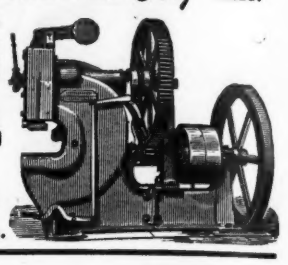

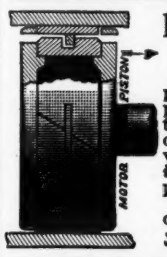

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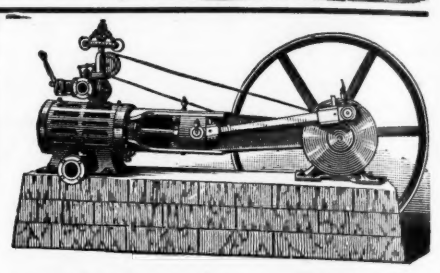

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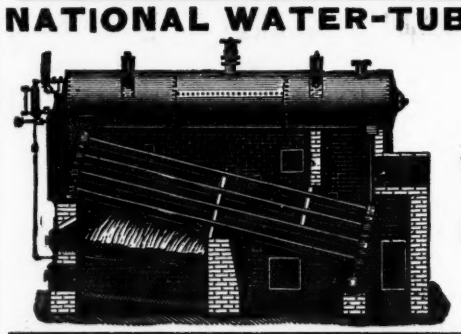

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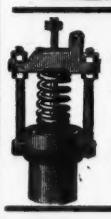

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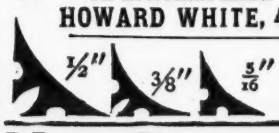

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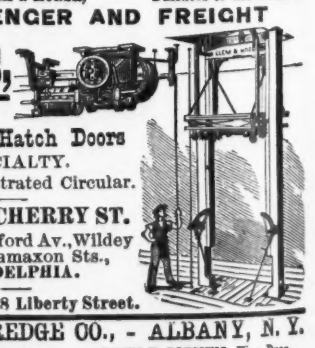

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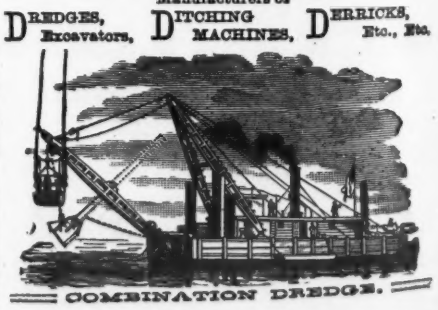

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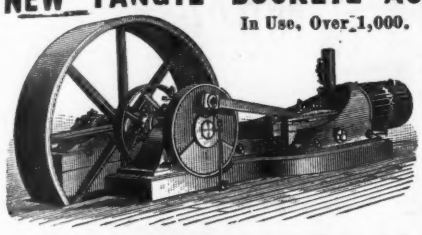

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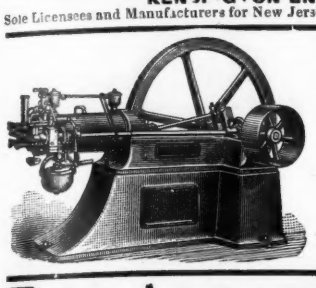

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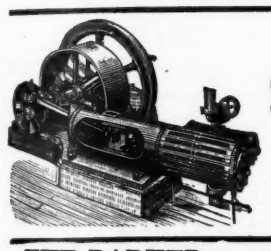

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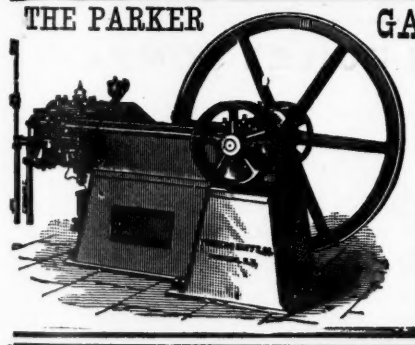

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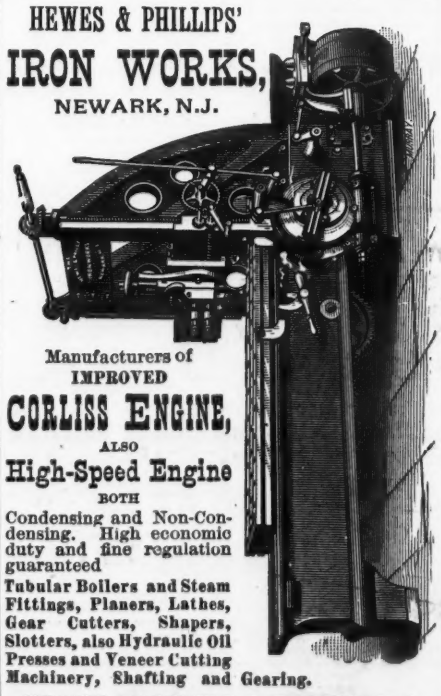

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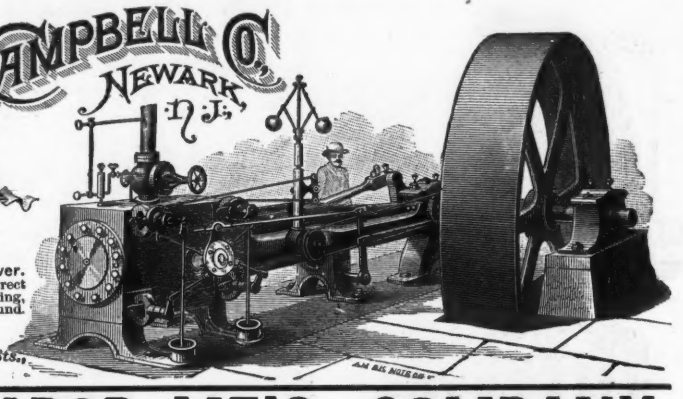

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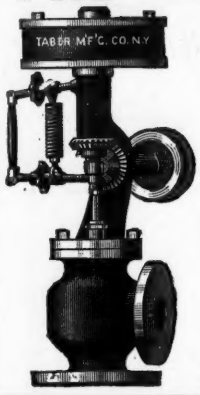

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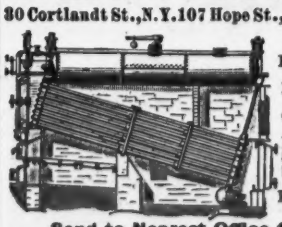

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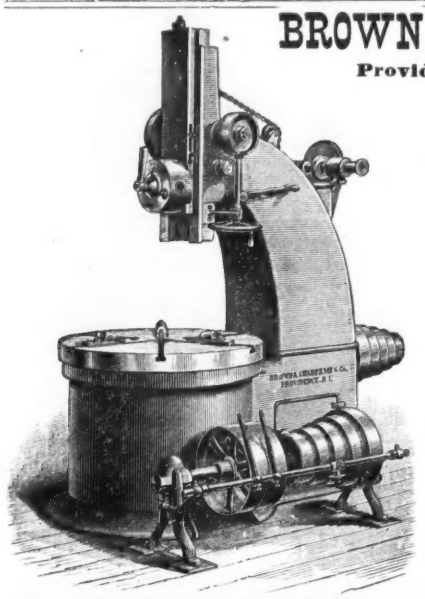

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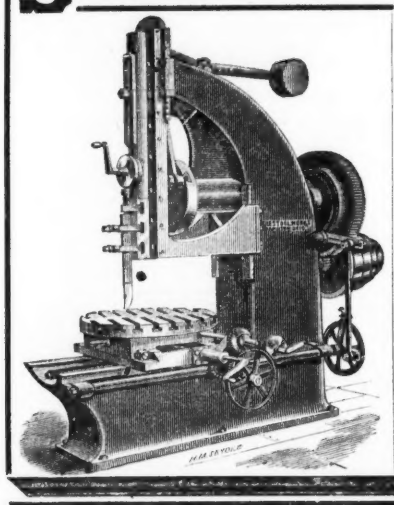

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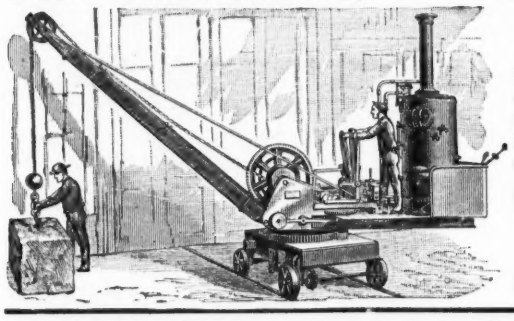

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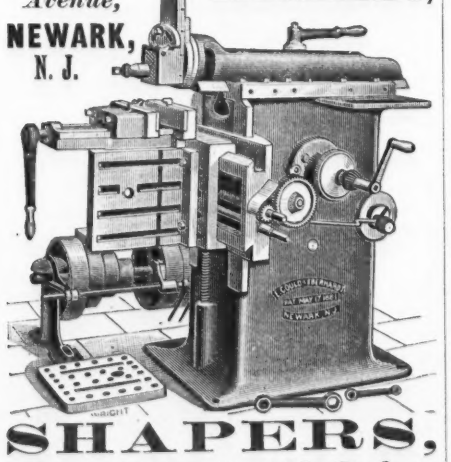

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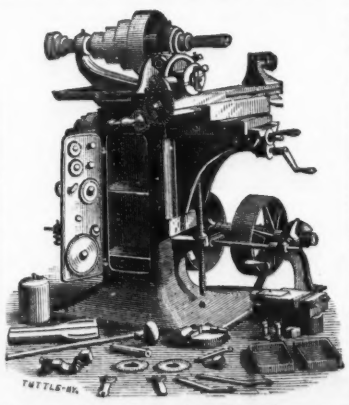

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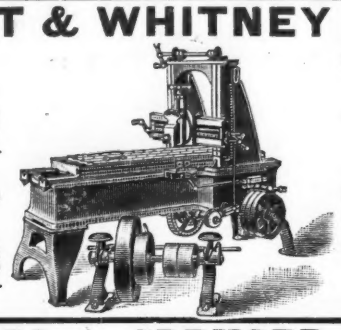

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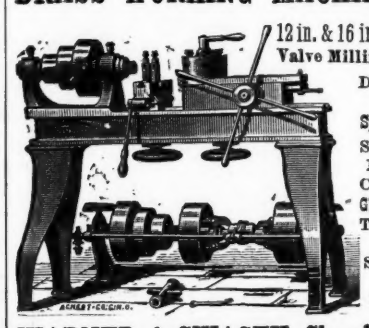

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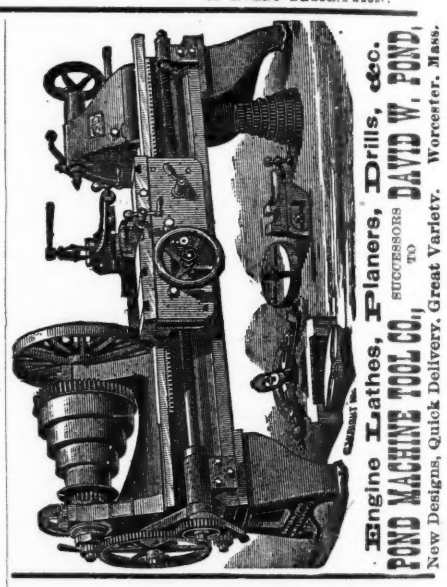

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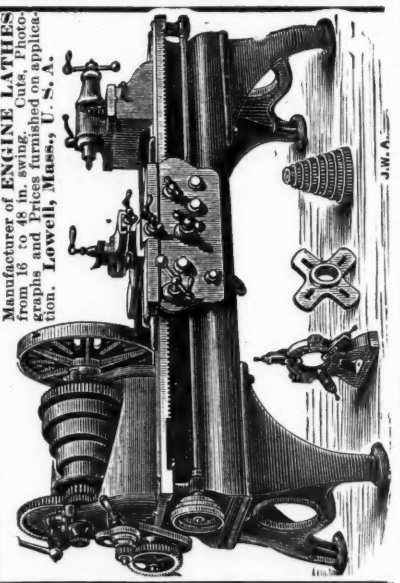

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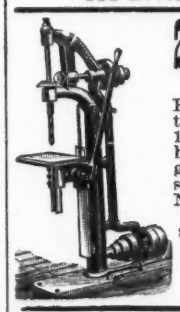

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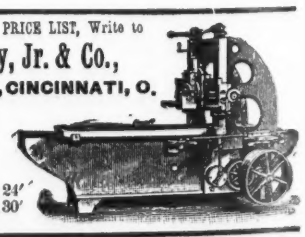

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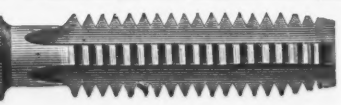

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